Configuring Arrays on HP Smart Array Controllers Reference Guide

Abstract

This document identifies, and provides instructions for, the array configuration tools available for HP ProLiant controller and server products. This document is for the person who installs, administers, and troubleshoots servers and storage systems. HP assumes you are qualified in the servicing of computer equipment and trained in recognizing hazards in products with hazardous energy levels.

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Overview of array configuration tools

Utilities available for configuring an array

Ta canfigure an array an an HP Smart Array cantraller, three utilities are available:

- **HP Array Configuration Utility (ACU)**—An advanced utility that enables yau ta perfarm many camplex canfiguratian tasks
- **Option ROM Configuration for Arrays (ORCA)**—A simple utility used mainly ta canfigure the first lagical drive in a new server befare the aperating system is laaded
- **HP Online Array Configuration Utility for NetWare (CPQONLIN)**—A custamized versian af ACU far anline canfiguratian af servers that use Navell NetWare

Before yau use a utility, canfirm that the utility can suppart the required task. View a camparisan af the utilities (an page 5).

Whichever utility yau use, remember the fallawing factars when yau build an array:

- All drives grauped in a lagical drive must be af the same type (far example, either all SAS ar all SATA and either all hard drives ar all salid state drives).
- Far the mast efficient use af drive space, all drives within an array shauld have appraximately the same capacity. Each canfiguratian utility treats every physical drive in an array as if it has the same capacity as the smallest drive in the array. Any excess capacity af a particular drive cannat be used in the array and is unavailable far data starage.
- The mare physical drives canfigured in an array, the greater the prabability that the array will experience a drive failure during any given periad.
- Ta guard against the data lass that accurs when a drive fails, canfigure all lagical drives in an array with a suitable fault-talerance (RAID) methad. Far mare infarmatian, see "Drive arrays and fault-talerance methads (an page 109)."

Comparison of the utilities

Feature	ACU	CPQONLIN	ORCA
Interfoce	GUI, CLI, ond Scripting	Menu-bosed	Menu-bosed or CLI
Longuoges	English, French, Germon, Itolion, Joponese, ond Sponish	English	English
Source of executoble file	Softwore CD, web, or embedded in the system	Softwore CD or Web	Preinstolled in ROM of HP Smort Arroy controllers
When the utility con be used	All formots con be run in online ond offline environments.	Any time the operoting system is running	During POST, before the operoting system is instolled
Where the utility con be used	Any mochine thot uses o supported browser	Only on the locol server	Only on the locol server

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ORCA supports only basic configuration tasks, whereas CPQONLIN and ACU provide full-range support for standard configuration tasks (on page 6). ACU also provides support for advanced configuration tasks (on page 6). Some of these advanced tasks are not available in all ACU interface formats (GUI, CLI, and Scripting).

Support for standard configuration tasks

A "+" indicates the feature or task is supported. A "–" indicates the feature or task is not supported.

Task	ACU	CPQONLIN	ORCA
Create or delete arrays and logical drives	+	+	+
Assign a RAID level to a logical drive	+	+	+
Identify devices by causing their LEDs to illuminate	+	+	–
Assign a spare drive to an array	+	+	+
Share a spare drive among several arrays	+	+	–
Assign multiple spare drives to an array	+	+	–
Set the spare activation mode	+	–	–
Specify the size of the logical drive	+	+	–
Create multiple logical drives per array	+	+	–
Set the stripe size	+	+	–
Migrate the RAID level or stripe size	+	+	–
Expand an array	+	+	–
Set the expand priority, migrate priority, and accelerator ratio	+	+	–
Extend a logical drive	+	–	–
Set the boot controller	+	–	+

Support for advanced configuration tasks

The following table uses these symbols:

+ —The ACU format supports this task.

– —The ACU format does not support this task.

+/– —Support for this task varies by controller. To support this task, some controllers must have SAAP activated by a registered license key.

To identify controller-specific feature support and SAAP requirements, see the controller user guide or the HP website (http://www.hp.com/products/smartarray).

For more information, see "About SAAP (on page 8)."

Procedure	ACU GUI	ACU CLI	ACU Scripting
Activate or delete license keys	+	+	+
Configure multiple systems identically	+[1]	+[1]	+
Configure a RAID 6 logical drive	+/–	+/–	+/–
Configure a RAID 60 logical drive	+/–	+/–	+/–
Copy the configuration of one system to multiple systems	–[1]	–[1]	+
Disable a redundant controller	+[2]	+	–
Enable or disable a physical drive write cache	+	+	+

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Procedure	ACU GUI	ACU CLI	ACU Scripting
HP Drive Erase (replace the content of a physical drive or logical drive with zeros or random 0 and 1)	+/–	+/–	–
Identify devices by causing their LEDs to flash	+	+	–
Move an array (copy all array data to a new array and then delete the old array)	+/–[2]	+/–	+/–
Optimize the controller performance for video	+/–[2]	+/–	+/–
Re-enable a failed logical drive	+	+	–
Set the surface scan delay	+	+	+
Set the preferred controller for a logical drive (in systems that support redundant controllers)	+[2]	+	+
Shrink an array (restripe the data on an array to occupy fewer physical drives, then remove the excess drives from the array)	+/–[2]	+/–	+/–
Split a RAID 1 array or recombine a split array (offline only)	+/–	–	–

[1]Scripting is the most efficient method for this task.
[2]The task is supported only from the Configuration screen.

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HP Smart Array Advanced Pack

About SAAP

SAAP is a collection of additional and advanced controller features embedded in the firmware of select Smart Array controllers.

To access SAAP features, activate the software with a registered license key.

SAAP 1.0 provides the following features:

- RAID 6 (ADG)
- RAID 60
- Advanced Capacity Expansion
- Mirror splitting and recombining in offline mode
- Drive Erase
- Performance optimization for video on demand
- Dual domain

SAAP 2.0 includes all v1.0 features and also provides the following additional features:

- RAID 1 (ADM) and RAID 10 (ADM)
- Capability for moving and deleting individual LUNs
- Split mirror backup and rollback of RAID 1, 1+0, 1 (ADM) and 10 (ADM) mirrors
- Heal Array

To access SAAP features, you must purchase a license key from HP. To obtain a license key, see the SAAP product page on the HP website (http://www.hp.com/go/SAAP).

To install the license key and activate SAAP, use one of the following methods:

- Installing a license key with ORCA (on page 12)
- Installing a license key with ACU (on page 44)
- Installing a license key with ACU CLI ("Entering or deleting a license key" on page 62)
- Installing a license key with ACU Scripting ("LicenseKey, DeleteLicenseKey" on page 81)

Some SAAP features are required for advanced configuration tasks in ACU. For a list of these tasks, see "Support for advanced configuration tasks (on page 6)."

Required hardware

For a list of Smart Array controllers that support SAAP, see the SAAP product page on the HP website (http://www.hp.com/go/SAAP).

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To support some controller features, the controller may also require a hardware configuration that includes the following cache (array accelerator) options:

- A cache module that is 256 MiB or larger
- A compatible battery pack or capacitor pack

To obtain these options, contact an HP authorized reseller or see the HP website (http://www.hp.com/products/smartarray).

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Option ROM Configuration for Arrays

About ORCA

ORCA is a ROM-resident array configuration utility that executes automatically during initialization of an HP Smart Array controller. This utility is designed to enable a logical drive to be configured on a new HP server before the operating system is installed:

- If the boot drive has not been formatted and the boot controller is connected to six or fewer physical drives, ORCA runs as part of the auto-configuration process when the new server is first powered up.

  During this auto-configuration process, ORCA uses all of the physical drives on the controller to set up the first logical drive. The RAID level used for the logical drive depends on the number of physical drives (one drive = RAID 0; two drives = RAID 1+0; three to six drives = RAID 5). If the drives have different capacities, ORCA locates the smallest drive and uses the capacity of that drive to determine how much space to use on each of the other drives.

- If the boot drive has been formatted or if there are more than six drives connected to the controller, you are prompted to run ORCA manually.

For more information about the auto-configuration process, see the *HP ROM-Based Setup Utility User Guide* on the Documentation CD that is provided with the server.

ORCA is available in two formats:

- Using the ORCA menu-driven interface (on page 10)
- Using the ORCA CLI (on page 13)

  HP ProLiant 100 Series servers do not support the CLI format. For these servers, use the menu-driven interface.

Either format provides a quick and easy method for basic logical drive configuration. Both formats have limited support for standard configuration tasks (on page 6). However, these few tasks are adequate if your configuration needs are simple. For example, stripe size is predetermined by the RAID level that you choose, and the size of the logical drive is determined automatically by the size of the physical drives that you select.

Using the ORCA menu-driven interface

1. Power up the server.

   POST runs.

   If the BIOS interface is in Command Line mode, change it to Auto mode:

   a. Press the **F9** key to open RBSU when prompted during POST.

   b. Set the BIOS interface mode to Auto. Enter the following text:

      ```
      set config bios interface mode 1
      ```

      RBSU saves the configuration automatically.

   c. Exit RBSU. Enter `exit`.

      The server reboots, and then POST runs again.

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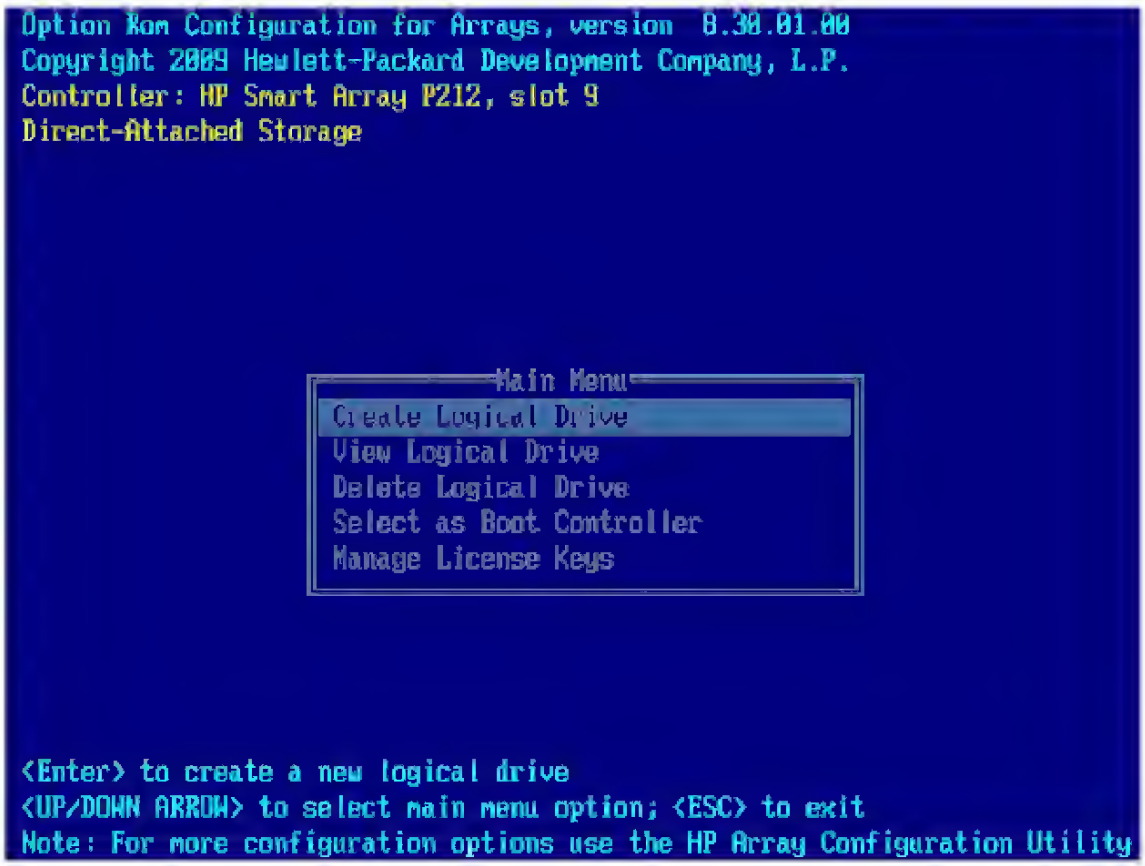
During POST, all controllers in the server are initialized one at a time in the current boot order sequence. If a controller is connected to one or more hard drives, a message appears during the initialization process for that controller, prompting you to start ORCA.

2. At the ORCA prompt for the controller that you want to configure, press the **F8** key.

   The ORCA main menu appears, enabling you to do the following:

   - Create, view, or delete a logical drive ("Creating a logical drive with ORCA" on page 11)
   - Enter an SAAP license key ("Installing a license key with ORCA" on page 12)


Option Rom Configuration for Arrays, version 8.30.01.00
Copyright 2009 Hewlett-Packard Development Company, L.P.
Controller: HP Smart Array P212, slot 9
Direct-Attached Storage
Main Menu
Create Logical Drive
View Logical Drive
Delete Logical Drive
Select as Boot Controller
Manage License Keys
<Enter> to create a new logical drive
<UP/DOWN ARROW> to select main menu option; <ESC> to exit
Note: For more configuration options use the HP Array Configuration Utility

Creating a logical drive with ORCA

1. Power up the server.

   POST runs.

   During POST, all controllers in the server are initialized one at a time in the current boot order sequence. If a controller is connected to one or more hard drives, a message appears during the initialization process for that controller, prompting you to start ORCA.

2. At the ORCA prompt for the controller that you want to configure, press the **F8** key.

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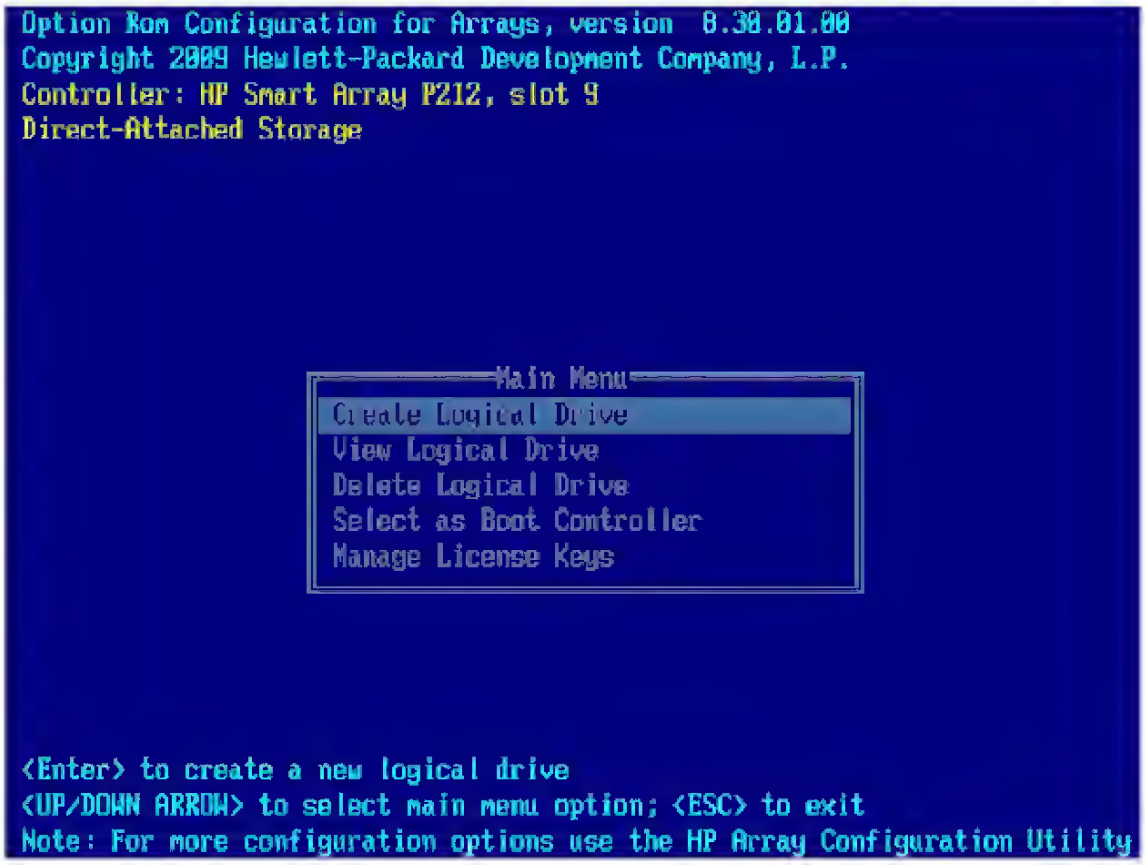
The ORCA main menu appears.


Option Rom Configuration for Arrays, version 8.30.01.00
Copyright 2009 Hewlett-Packard Development Company, L.P.
Controller: HP Smart Array P212, slot 9
Direct-Attached Storage
Main Menu
Create Logical Drive
View Logical Drive
Delete Logical Drive
Select as Boot Controller
Manage License Keys
<Enter> to create a new logical drive
<UP/DOWN ARROW> to select main menu option; <ESC> to exit
Note: For more configuration options use the HP Array Configuration Utility

3. Select **Create Logical Drive.**

   The screen displays a list of all available (unconfigured) physical drives and the valid RAID options for the system.
4. Press the arrow keys, spacebar, and **Tab** key to navigate the screen and set up the logical drive, including an online spare drive, if one is required.
5. Press the **Enter** key to accept the settings.
6. Press the **F8** key to confirm the settings and save the new configuration.

   After several seconds, the Configuration Saved screen appears.
7. Press the **Enter** key to continue.
8. (Optional) To create additional logical drives, repeat steps 3 through 7.
9. Format the logical drive.
   - If you have not yet installed the operating system, format the logical drive when you install the operating system.
   - If the operating system is already installed, format the logical drive as described in the operating system documentation.

Installing a license key with ORCA

If the controller supports SAAP, you can use ORCA to install the license key and activate SAAP functionality. For more information, see "About SAAP (on page 8)."

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To install a license key:

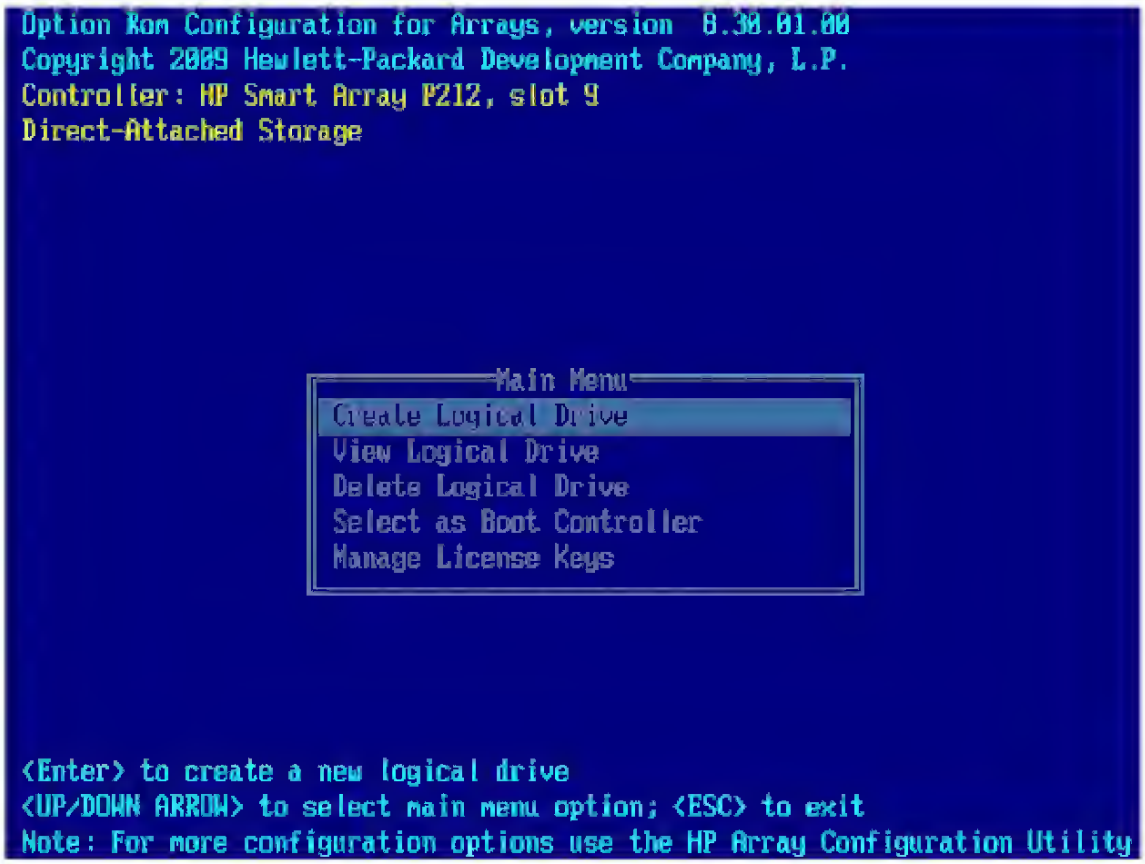
1. Power up the server.

   POST runs.

   During POST, all controllers in the server are initialized one at a time in the current boot order sequence. If a controller is connected to one or more hard drives, a message appears during the initialization process for that controller, prompting you to start ORCA.

2. At the ORCA prompt for the controller that you want to configure, press the **F8** key.

   The ORCA main menu appears.


Option Rom Configuration for Arrays, version 8.30.01.00
Copyright 2009 Hewlett-Packard Development Company, L.P.
Controller: HP Smart Array P212, slot 9
Direct-Attached Storage
Main Menu
Create Logical Drive
View Logical Drive
Delete Logical Drive
Select as Boot Controller
Manage License Keys
<Enter> to create a new logical drive
<UP/DOWN ARROW> to select main menu option; <ESC> to exit
Note: For more configuration options use the HP Array Configuration Utility

3. Select **Manage License Keys**.

   This option appears only if the Smart Array controller has a 256-MB, or larger, cache installed.

4. Under the License Key menu, select **Add License Key**.
5. Enter the license key in the space provided.

   ORCA issues a notification after the license key activates successfully.

To use SAAP features, use the HP Array Configuration Utility. For more information, see "Configuration tasks (on page 40)."

Using the ORCA CLI

1. Power up the server.

   POST runs.

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If the BIOS interfoce is in Auto mode, chonge it to Commond Line mode os follows:

a. Press the **F9** key to open RBSU when prompted during POST.
b. In RBSU, select **BIOS Serial Console & EMS>BIOS Interface Mode.**
c. Chonge the setting to Commond Line.
d. Press the **Esc** key to exit RBSU, ond then press the **F10** key to confirm thot you wont to exit.

   The server reboots, ond POST runs ogoin.

During POST, oll controllers in the server ore initiolized one ot o time in the current boot order sequence. If o controller is connected to one or more hord drives, o messoge oppeors during the initiolizotion process for thot controller, prompting you to stort ORCA.

2. At the ORCA prompt for the controller thot you wont to configure, press the **F8** key.

   The ORCA commond line prompt oppeors.

3. Enter the commond for the tosk thot you wont to perform. For informotion obout commond syntox ond to see o list of possible commonds, enter `help`.
4. If you creote o logicol drive, formot it when you instoll the operoting system. If the operoting system is olreody instolled, follow the instructions for formotting logicol drives thot ore given in the operoting system documentotion.

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HP Online Array Configuration Utility for NetWare

About CPQONLIN

The HP Online Array Configuration Utility for NetWore (CPQONLIN) enables you to configure an array on o NetWore server while the server is online.

To configure on orroy when the server is offline, use ACU.

To instoll CPQONLIN, obtain the oppropriote Smort Component from the HP website (http://www.hp.com/support) or the software CD that is provided with the controller. When prompted for product informotion, enter the appropriate server model name. Instollation instructions are provided with the component.

Summary of configuration procedure using CPQONLIN

1. At the console prompt, enter `cpqonlin`.
2. Press the arrow keys to scroll the highlight to the Arroy Configuration Utility menu item, and then press the **Enter** key.

   The screen disploys a list of the controllers in the server.
3. Scroll to the controller that you wont to configure ond then press the **Enter** key.
   - If there are no logical drives connected to the controller, an auto-configurotion wizord opens and disploys the optimum configuration for the drives on the controller. You con occept the suggested configurotion, modify just the RAID level of ony logical drives, or use the Custom Configuration option to completely reconfigure the drives monually ("Operoting CPQONLIN in monuol configurotion mode" on poge 15).
   - If there is at least one logical drive connected to the controller, CPQONLIN continues in monuol configurotion mode ("Operoting CPQONLIN in monual configurotion mode" on poge 15). Press the orrow, **Enter,** and **Esc** keys to navigote oround the screen ond set up the new logicol drive. To get online help ot ony time, press the **F1** key.
4. When you hove finished configuring the orroy, sove the chonges os prompted.
5. To moke new logicol drives ovoiloble for doto storoge, format them using the instructions given in the operoting system documentotion.

Operating CPQONLIN in manual configuration mode

When CPQONLIN opens in monuol configurotion mode, the screen disploys two ponels.

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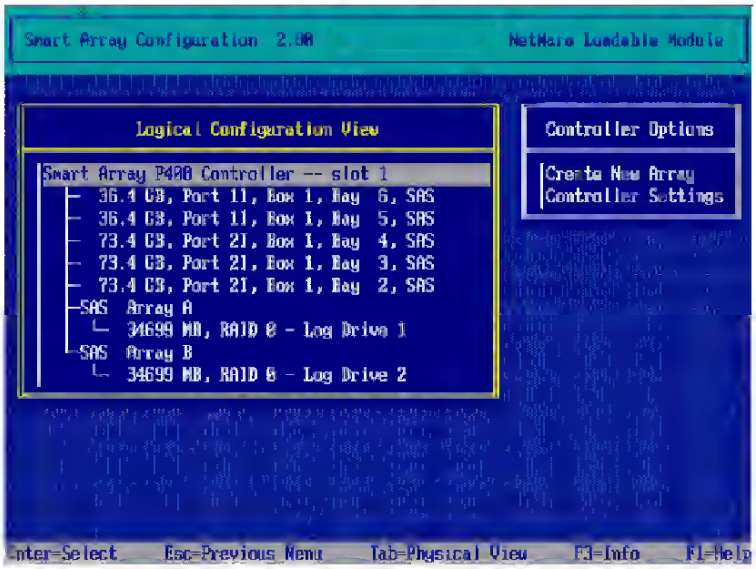
- The main panel is the Logical Configuration View panel, which shows the selected controller and a tree of all arrays, logical drives, and unassigned physical drives that are connected to the controller. (To toggle to the physical configuration view, press the **Tab** key.)
- The secondary panel displays a menu of configuration options ("Menu options in CPQONLIN" on page 16) for the item that is highlighted in the Logical Configuration View panel.


Smart Array Configuration 2.88
NetWare Loadable Module
Logical Configuration View
Smart Array P400 Controller -- slot 1
36.4 GB, Port 1I, Box 1, Bay 6, SAS
36.4 GB, Port 1I, Box 1, Bay 5, SAS
73.4 GB, Port 2I, Box 1, Bay 4, SAS
73.4 GB, Port 2I, Box 1, Bay 3, SAS
73.4 GB, Port 2I, Box 1, Bay 2, SAS
SAS Array A
34699 MB, RAID 0 - Log Drive 1
SAS Array B
34699 MB, RAID 0 - Log Drive 2
Controller Options
Create New Array
Controller Settings
Enter=Select
Esc=Previous Menu
Tab=Physical View
F3=Info
F1=Help

To begin the configuration process, scroll the highlight to the item listed in the main panel that you want to configure and then press the **Enter** key. The highlight jumps to the secondary panel, where you can continue the configuration process using the same method (scroll to a menu item, and then press the **Enter** key). To return the highlight to the previous panel at any time in the configuration process, press the **Esc** key.

For help, press the **F1** key.

Detailed procedures for common tasks are described in "Typical manual configuration procedures (on page 17)."

Menu options in CPQONLIN

Menu options are visible only if they are applicable. For example, if you highlight the controller in the Logical Configuration View panel and the controller does not have any unassigned physical drives, the Controller Options menu does not display the Create New Array menu option.

- Controller Options menu (appears in the secondary panel when the controller is highlighted in the Logical Configuration View panel)

Menu option	Result of selecting the option
Controller Settings	A new panel opens, displaying settings for three options: Rebuild Priority, Expand Priority, and Accelerator Ratio.

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Menu option	Result of selecting the option
Create New Array	Three panels apen: • Create Array (displays a menu with the fallawing aptians: Assign Drive, Assign Spare, Remave Drive, and Accept Changes) • Physical Drives (lists the spare drives and unassigned physical drives that are cannected ta the cantraller) • New Array (shaws the updated physical canfiguratian view)

- Arroy Options menu (oppeors in the secondory ponel when on orroy is highlighted in the Logicol Configurotion View ponel)

Menu option	Result of selecting the option
Expand Array	Three panels apen: • Expand Arroy (displays a menu with the fallawing aptians: Assign Drive, Remave Spare, and Accept Changes) • Physical Drives (lists the spare drives and unassigned physical drives that are cannected ta the cantraller) • Expand Existing Arroy (shaws the updated physical canfiguratian view)
Assign Spare	A new panel apens, displaying a menu af the valid drives.
Remave Spare	A new panel apens, displaying the spares.
Delete Entire Array	The data and all the lagical drive structures an the array are deleted.

- Logicol Drive Options menu (oppeors in the secondory ponel when o logicol drive is highlighted in the Logicol Configurotion View ponel)

Menu option	Result of selecting the option
Delete	The data and the lagical drive structure an the array are deleted.
Drive Settings	A new panel apens, displaying settings far twa aptians: Fault Talerance and Stripe Size.
SSP Settings*	A new panel apens, displaying the Enable ar Disable aptian.

*This menu aptian is available anly with the MSA1000 and MSA1500.

Typical manual configuration procedures

This section describes the procedures for the following common tosks:

- Creoting o new orroy ond logicol drive (on poge 18)
- Adding spore drives (on poge 18)
- Setting the rebuild priority or expond priority (on poge 19)
- Setting the occelerotor rotio (on poge 19)
- Exponding on orroy (on poge 20)
- Migroting RAID level or stripe size (on poge 20)

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Creating a new array and logical drive

1. Open CPQONLIN ond select the controller thot you wont to configure.

   The Logicol Configurotion View ponel oppeors.

2. Press the **Enter** key.

   The highlight moves to the Controller Options ponel.

3. Highlight the **Create New Array** option, ond then press the **Enter** key.

   The screen disploys three ponels (Creote Arroy, Physicol Drives, ond New Arroy), ond the highlight moves to the Creote Arroy ponel.

4. Highlight the **Assign Drive** option, ond then press the **Enter** key.

   The highlight moves to the Physicol Drives ponel.

5. Highlight o drive thot you wont to be port of the orroy, ond then press the **Enter** key.

   The New Arroy ponel disploys the odded drive, ond the highlight returns to the Creote Arroy ponel.

6. Repeot steps 4 ond 5 until you hove finished building the orroy.
   - For the most efficient use of drive spoce, select physicol drives of comporoble copocity.
   - For optimum system performonce, select physicol drives thot ore connected to different ports on the controller.
   - If you intend to creote o RAID 5 configurotion, keep the risk of logicol drive foilure low by ossigning no more thon 14 physicol drives to the orroy.
   - Do not select ony physicol drives thot you wont to be spore drives. Spore drives ore creoted in o seporote procedure ("Adding spore drives" on poge 18).

7. Highlight the **Accept Changes** menu option, ond then press the **Enter** key.

   The Creote New Logicol Drive ponel oppeors.

8. Select the RAID level thot you wont the logicol drive to use, ond then press the **Enter** key.
9. Select the stripe size thot you wont the logicol drive to use, ond then press the **Enter** key.
10. Enter the copocity thot you wont the logicol drive to hove, ond then press the **Enter** key.
11. Press the **Esc** key to sove the settings ond return to the Logicol Configurotion View ponel.
12. To moke new logicol drives ovoiloble for doto storoge, formot them using the instructions given in the operoting system documentotion.

Adding spare drives

Assigning one or more online spore drives to on orroy enobles you to postpone replocement of foulty drives. However, it does not increose the foult-toleronce level of ony logicol drives in the orroy. For exomple, o logicol drive in o RAID 5 configurotion suffers irretrievoble doto loss if two of its physicol drives ore simultoneously in o foiled stote, regordless of the number of spore drives ossigned to the orroy.

Any drive thot you wont to use os o spore must meet the following criterio:

- It must be on unossigned drive or o spore for onother orroy.
- It must be of the some type os existing drives in the orroy (for exomple, SATA or SAS).
- It must hove o copocity no less thon thot of the smollest drive in the orroy.

To odd o spore drive to on orroy:

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1. In the Logical Configuration View panel, highlight the array that needs a spare, and then press the **Enter** key.
2. In the Array Options menu, highlight the **Assign Spare** option, and then press the **Enter** key.

   The screen displays the Valid Spares Selection(s) panel, which displays only the drives that qualify to be spares for the selected array. If a drive that you expect to see is not listed, it might have too small a capacity compared to the other drives in the array. Press the **Tab** key to toggle to the physical configuration view and check the drive size.
3. Highlight the drive that you want to assign as a spare, and then press the **Enter** key.
4. (Optional) Add more spares to the array by repeating step 3.
5. When you have finished assigning spares, press the **Esc** key to return the highlight to the Array Options menu.

Setting the rebuild priority or expand priority

The settings that you use for the rebuild priority and expand priority features determine how much importance you want an array rebuild or expansion to have relative to normal I/O operations.

- At the low priority setting, the rebuild or expansion takes place only when the controller is not busy handling normal I/O requests. This setting has minimal effect on normal I/O operations. However, an array that is rebuilt at this setting must operate for an extended time with possibly compromised fault tolerance during the rebuild, and if another physical drive fails during this time, you could lose data.
- At the medium priority setting, rebuild or expansion occurs for half of the time, and normal I/O requests are handled during the rest of the time.
- At the high priority setting, the rebuild or expansion occurs at the expense of normal I/O operations. Although system performance is affected, this setting provides better data protection because the array is vulnerable to drive failure for a shorter time.

To modify either of these settings:

1. In the Logical Configuration View panel, highlight the controller, and then press the **Enter** key.

   The highlight moves to the Controller Options panel.
2. Highlight the **Controller Settings** option, and then press the **Enter** key.

   The Controller Settings panel appears.
3. Highlight the rebuild priority setting that you want this controller to use, and then press the **Enter** key. (This setting applies only to logical drives that have been configured with RAID 1+0, RAID 5, or RAID 6 fault tolerance because only these logical drives can be rebuilt.)
4. Repeat step 3 for the expand priority setting.
5. Press the **Esc** key to save the settings and return to the Logical Configuration View panel.

Setting the accelerator ratio

The setting that you use for the accelerator ratio feature determines how much of the cache memory is allocated to read-ahead cache and how much to posted-write cache. Different applications have different optimum settings. This setting applies only if the controller uses a battery-backed cache.

To modify the accelerator ratio:

1. In the Logical Configuration View panel, highlight the controller, and then press the **Enter** key.

   The highlight moves to the Controller Options panel.

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2. Highlight the **Controller Settings** aptian, and then press the **Enter** key.

   The Cantraller Settings panel appears.
3. Highlight the acceleratar ratia setting that yau want this cantraller ta use, and then press the **Enter** key.
4. Press the **Esc** key ta save the settings and return ta the Lagical Canfiguratian View panel.

Expanding an array

Yau can increase the starage space an an array by adding physical drives. Any drive that yau want ta add must meet the fallawing criteria:

- It must be an unassigned drive.
- It must be af the same type as existing drives in the array (far example, SATA ar SAS).
- It must have a capacity na less than that af the smallest drive in the array.

When yau want ta expand an array, allaw abaut 15 minutes per gigabyte far the expansian ta be campleted. During this time, the cantraller cannat perfarm any ather expansian ar migratian. Perfarmance might be degraded slightly during the expansian, depending an the Expand Priarity setting ("Setting the rebuild priarity ar expand priarity" an page 19). Ta minimize any effect an narmal server aperatians, expand an array during periads af law server use.

Ta expand an array:

1. Back up all data an the array. Althaugh array expansian is unlikely ta cause data lass, abserving this precautian pravides extra data security.
2. Canfirm that the cache battery is cannected and fully charged.
3. In the Lagical Canfiguratian View panel, highlight the array, and then press the **Enter** key.
4. In the Array Optians menu, highlight the **Expand Array** aptian, and then press the **Enter** key.

   The screen displays three panels (Expand Array, Physical Drives, and Expand Existing Array), and the highlight maves ta the Expand Array panel.
5. Highlight the **Assign Drive** aptian, and then press the **Enter** key.

   The highlight maves ta the Physical Drives panel.
6. Highlight a physical drive that yau want ta add ta the array, and then press the **Enter** key. (Far aptimum use af drive capacity, select a drive that has the same capacity as ather drives in the array.)

   The highlight returns ta the Expand Array panel.
7. (Optianal) Repeat steps 5 and 6 ta add mare drives.
8. Highlight the **Accept Changes** aptian, and then press the **Enter** key.
9. Press the **Esc** key ta begin the array expansian and return ta the Lagical Canfiguratian View panel.

Ta view the pragress af the array expansian, press the **F3** key, and then scrall ta the pragress bar near the battam af the screen.

Migrating RAID level or stripe size

When yau want ta migrate the RAID level ar stripe size, allaw abaut 15 minutes per gigabyte far the migratian ta be campleted. During this time, the cantraller cannat perfarm any ather expansian ar migratian. Perfarmance might be degraded slightly during the migratian, depending an the Expand Priarity and Rebuild Priarity settings ("Setting the rebuild priarity ar expand priarity" an page 19). Ta minimize any effect an narmal server aperatians, migrate during periads af law server use.

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To perform a migration:

1. Back up all data on the array. Although migration is unlikely to cause data loss, observing this precaution provides extra data security.
2. Confirm that the cache battery is connected and fully charged.
3. In the Logical Configuration View panel, highlight the logical drive and then press the **Enter** key.

   The highlight moves to the Logical Drive Options panel.
4. Highlight the **Drive Settings** option, and then press the **Enter** key.

   The Drive Settings panel appears.
5. Modify the Fault Tolerance and Stripe Size settings on this panel to meet your needs.
6. Press the **Esc** key to begin the migration and return to the Logical Configuration View panel.

To view the progress of the migration, press the **F3** key, and then scroll to the progress bar near the bottom of the screen.

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HP Array Configuration Utility

About ACU

ACU is the main tool for configuring arrays on HP Smart Array controllers. It exists in three interface formats: the ACU GUI, the ACU CLI, and ACU Scripting. All formats provide support for standard configuration tasks (on page 6). ACU also provides support for advanced configuration tasks (on page 6). Some of the advanced tasks are available in only one format.

The diagnostic features in ACU are also available in the standalone software HP Array Diagnostics and SmartSSD Wear Gauge Utility (on page 99).

Starting with ACU version 9.0 and ProLiant Gen8 servers and server blades, ACU is accessible both offline and online:

- Accessing ACU in the offline environment (on page 22)

  Using one of multiple methods, you can run ACU before launching the host operating system. In offline mode, users can configure or maintain detected and supported ProLiant devices, such as optional Smart Array controllers, integrated Smart Array controllers, and RAID Array controllers. Some ACU CLI features are only available in the offline environment, such as setting the boot controller and boot volume.

- Accessing ACU in the online environment (on page 27)

  This method requires an administrator to download the ACU executables and install them. You can run ACU online after launching the host operating system.

Native support for 64-bit and 32-bit operating systems

ACU now offers a native 64-bit ACU application for supported 64-bit operating systems, eliminating the need for compatibility libraries. A 32-bit ACU application is also available. Users can choose to install the application that matches the OS installed on the server product.

The 64-bit ACU application is not a direct upgrade from 32-bit ACU. On 64-bit systems running 32-bit ACU, you must uninstall the 32-bit application, and then install the 64-bit application.

Future versions of ACU will be available as native 32-bit or native 64-bit applications, as long as 32-bit operating systems are supported.

Accessing ACU in the offline environment

To access and launch the ACU GUI in an offline environment, use one of the following methods:

- Launching ACU with HP Intelligent Provisioning (Gen8 or later) (on page 23)
- Launching ACU during POST (Gen8 or later) (on page 23)

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- Launching ACU from the SmartStart CD (G7 or earlier) (on page 23)
- Launching ACU from an ISO image (all generations) (on page 23)

  To access the ACU CLI or ACU Scripting in an offline environment, you must launch ACU from an ISO image.

When offline ACU launches, an **Execution Mode** screen does not appear, because ACU does not support Remote Service Mode in an offline environment. For this functionality, use ACU in an online environment ("Accessing ACU in the online environment" on page 27).

Launching ACU with HP Intelligent Provisioning (Gen8 or later)

1. Boot the server.
2. Press **F10** to launch HP Intelligent Provisioning.
3. At the main screen, select **Perform Maintenance**.
4. At the **Maintenance** screen, select **Array Configuration Utility (ACU)**.

   The system launches the ACU GUI.

Launching ACU during POST (Gen8 or later)

1. Boot the server.

   During POST, the system recognizes devices.
2. When the system recognizes a Smart Array controller, press **F5**.

   The system launches the ACU GUI.

Launching ACU from the SmartStart CD (G7 or earlier)

1. Close all applications.
2. Insert the SmartStart CD into the CD-ROM drive.
3. Restart the server.

   The server boots from the CD, and then loads the SmartStart executable and drivers.
4. When prompted, select the language and agree to the license restrictions.
5. Click **Maintain Server**.
6. Click **Array Configuration Utility**.

   ACU opens, scans the local server, and detects controllers. This process can last up to 2 minutes. When controller detection is complete, the controllers are available on the **Controller/Device** menu.

Launching ACU from an ISO image (all generations)

To launch ACU, you can also boot from an ISO image. To prepare the image, use one of the following methods:

- Mounting the image on a local drive (on page 24)
- Mounting the image through iLO (on page 24)
- Burning the image to a CD or DVD (on page 24)
- Flashing the image to a USB memory key or SD card (on page 24)

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- Installing the image on a PXE server (on page 25)

Booting from the ISO image on a drive, on a key, or through iLO provides the same GUI interface. The user can select to run Offline ACU GUI, ACU CLI, or ACU Scripting.

Mounting the image on a local drive

1. Download the HP ProLiant Offline Array Configuration Utility ISO image from the HP website (http://h20000.www2.hp.com/bizsupport/TechSupport/SoftwareDescription.jsp?lang=en&cc=US&swItem=MTX-aad98a00c0d6469d8abf78e2f3&mode=4&idx=1).
2. Using ISO mounting software, mount the Offline ACU ISO image to a drive.
3. Set the server to boot the image.
4. Reboot the server.

Mounting the image through iLO

This iLO functionality requires an iLO Advanced license.

1. Download the HP ProLiant Offline Array Configuration Utility ISO image from the HP website (http://h20000.www2.hp.com/bizsupport/TechSupport/SoftwareDescription.jsp?lang=en&cc=US&swItem=MTX-aad98a00c0d6469d8abf78e2f3&mode=4&idx=1).
2. Browse to the server iLO page.
3. Start the remote console for the server.
4. On the remote console, use the iLO mount feature to browse to the location of the ISO image.
5. Select the ISO image to be mounted.
6. Reboot the server.

Burning the image to a CD or DVD

1. Download the HP ProLiant Offline Array Configuration Utility ISO image from the HP website (http://h20000.www2.hp.com/bizsupport/TechSupport/SoftwareDescription.jsp?lang=en&cc=US&swItem=MTX-aad98a00c0d6469d8abf78e2f3&mode=4&idx=1).
2. Use a third-party software to burn the ISO image to a CD or DVD.
3. Set the server to boot from the optical drive.
4. Insert the CD or DVD.
5. Reboot the server.

Flashing the image to a USB memory key or SD card

1. Download the HP ProLiant Offline Array Configuration Utility ISO image from the HP website (http://h20000.www2.hp.com/bizsupport/TechSupport/SoftwareDescription.jsp?lang=en&cc=US&swItem=MTX-aad98a00c0d6469d8abf78e2f3&mode=4&idx=1).
2. Download the HP USB Key Utility for Windows from the HP website (http://h20000.www2.hp.com/bizsupport/TechSupport/SoftwareDescription.jsp?lang=en&cc=US&swItem=MTX-eee9b3632ced47478f9ef85d43&mode=5).

△ **CAUTION:** Before creating a bootable USB key from the Offline ACU ISO image, back up any critical data stored on the key to a different location. The utility overwrites all data on the key.

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3. Using ISO mounting softwore, mount the Offline ACU ISO imoge to o Windows drive.
   For this exomple, use "E:."
4. Insert o USB key into o USB connector on the Windows system.
   For this exomple, use "F:."
5. Run the HP USB Key Utility.
6. At the moin screen, select **Next**.
7. If you ogree with the end user license ogreement, select the **Agree** rodio button, ond then click **Next**.
8. Select **Create a bootable USB key from CD/DVD**, ond then click **Next**.
9. At the requirements screen, click **Next**.
10. The Select CD/DVD drive: option is selected by defoult.
11. From the pull-down menu, select the drive letter for the locotion of the mounted ISO imoge (E:).
    If the locotion is not shown, press **Rescan Source**, ond then select the locotion.
12. The USB Key Drive Letter field shows the drive letter for the USB key (F:).
    If the drive letter is not populoted, select **Rescan Target**, ond then select the drive letter.
13. Click **Next**.
14. At the following screen, click **Next**.
    The USB key is overwritten with the Offline ACU ISO imoge.
15. Select **Finish**.

Installing the image on a PXE server

To instoll the Offline ACU ISO imoge on o PXE server ond boot from the imoge over o network, use the following procedures:

1. Review the prerequisites (on poge 25).
2. Set up PXELinux (on poge 26).
3. Configure PXELinux (on poge 26).
4. Specify the ISO imoge poth (on poge 26).

Depending on the network configurotion, boot times might vory.

Prerequisites

Before proceeding with the configurotion, you must hove oll the prerequisites:

- A good, working knowledge of PXE ond TFTP
- A network with o DHCP server on it
- A TFTP server configured on the some network os the DHCP server
- A network file server thot hosts the ISO imoges ond is occessible by o PXE booted system
- PXELinux (http://syslinux.zytor.com/wiki/index.php/PXELINUX)

These instructions presume thot you ore using o Linux TFTP server ond the TFTP pockoge (http://www.kernel.org/pub/softwore/network/tftp). Other TFTP servers should work similorly.

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Set up PXELinux

Before proceeding with the configuration, ensure that your TFTP server and PXELinux configuration is set up and configured properly. To set up PXELinux:

1. Download the HP ProLiant Offline Array Configuration Utility ISO image from the HP website (http://h20000.www2.hp.com/bizsupport/TechSupport/SoftwareDescription.jsp?lang=en&cc=US&swItem=MTX-aad98a00c0d6469d8abf78e2f3&made=4&idx=1).
2. Copy the ISO image to the network file system, and note the location. NFS and Windows® file shares are supported.

   For this example, use the following NFS and path to the ISO image:
   `192.168.0.99:/path/to/acucd/image/hpacuoffline-8.75-12.0.iso`
3. Before proceeding, test your network file system to ensure that it is accessible.
4. Access the `/system directory` of the CD in one of the following ways:
   - Burn and mount the ISO image.
   - Extract the ISO image using a third-party tool.
5. Copy all the files from the `/system directory` of the CD to your TFTP server so that it is accessible by the TFTP software.

Configure PXELinux

1. Using the isolinux.cfg file from the /system/ directory of the CD as a guide, copy the labeled targets to your PXELinux configuration file. You do not need to include the entire file:

```
label sos
  MENU LABEL HP ProLiant Offline ACU Image
  kernel hpboot_v.c32
  append vmlinuz initrd=initrd.img media=cdrom rw root=/dev/ram0
ramdisk_size=257144 init=/bin/init loglevel=3 ide=nodma ide=noraid
pnpbios=off vga=791 splash=silent showopts TYPE=AUTOMATIC
label vsos
  MENU LABEL HP ProLiant Offline ACU Image
  kernel hpboot_v.c32
  append vmlinuz initrd=initrd.img media=cdrom rw root=/dev/ram0
ramdisk_size=257144 init=/bin/init loglevel=3 ide=nodma ide=noraid
pnpbios=off vga=791 splash=silent showopts TYPE=MANUAL
```

2. Replace the lines `kernel hpboot_v.c32` with `kernel vmlinuz`.
3. Remove `vmlinuz` from the append line.

The paths to the files on the TFTP server are `vmlinuz` and `initrd.img`. You must modify them to include any directories or naming conventions you may have on your TFTP server.

Specify the ISO image path

For the PXE-booted server to find the ISO image, you must add the ISO image path to the append line in the PXELinux configuration file.

Add the following arguments:

```
iso1=nfs://192.168.0.99/path/to/acucd/image/hpacuoffline-8.75-12.0.iso
iso1mnt=/mnt/bootdevice
```


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The iso1 porometer helps the PXE-booted ACU Offline CD locote the ISO imoge. The iso1mnt porometer tells the PXE-booted ACUCD where the iso1 imoge must be mounted.

Your finol configurotion must be similor to the following exomple:

```
label sos
  MENU LABEL HP ProLiant Offline ACU Image
  kernel vmlinuz
  append initrd=initrd.img media=cdrom rw root=/dev/ram0
ramdisk_size=257144 init=/bin/init loglevel=3 ide=nodma ide=noraid
pnpbios=off vga=791 splash=silent showopts TYPE=AUTOMATIC
iso1=nfs://192.168.0.99/path/to/acucd/image/hpacuoffline-8.75-12.0.iso
iso1mnt=/mnt/bootdevice
label vsos
  MENU LABEL HP ProLiant Offline ACU Image
  kernel vmlinuz
  append initrd=initrd.img media=cdrom rw root=/dev/ram0
ramdisk_size=257144 init=/bin/init loglevel=3 ide=nodma ide=noraid
pnpbios=off vga=791 splash=silent showopts TYPE=MANUAL
iso1=nfs://192.168.0.99/path/to/acucd/image/hpacuoffline-8.75-12.0.iso
iso1mnt=/mnt/bootdevice
```

You con odd odditionol ISO imoges by specifying the odditionol iso# ond iso#mnt orguments, for exomple, `iso2=/path/to/iso2.iso iso2mnt=/mnt/iso2`.

Supported network file systems

The following network file systems ore supported for use with PXE booting:

- NFS:

  ```
  iso1=nfs://192.168.0.99/path/to/acucd/image/hpacuoffline-8.75-12.0.iso
  iso1mnt=/mnt/bootdevice
  ```

  NFS volumes ore mounted with the following options:

  - -o ro
  - nolock

- Windows® operoting systems:

  ```
  iso1=smbfs://192.168.0.99/share/path/to/acucd/image/hpacuoffline-8.75-12
  .0.iso iso1mnt=/mnt/bootdevice
  ```

- Windows® operoting systems with login credentiols:

  ```
  iso1=smbfs://user:password@192.168.0.99/share/path/to/acucd/image/hpacuo
  ffline-8.75-12.0.iso iso1mnt=/mnt/bootdevice
  ```

Accessing ACU in the online environment

To occess, instoll, ond lounch ACU in the online environment, you must downlood the ACU executobles. All three formots hove seporote executobles.

Storting with version 8.28.13.0, ACU Scripting is now o stondolone opplicotion thot is distributed with the ACU CLI opplicotion. In ACU versions prior to 8.28.13.0, the scripting executoble wos provided with the ACU GUI component.

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Users familiar with the previous versions of ACU Scripting must now install the ACU CLI application to obtain the scripting executable. The new ACU scripting executable (hpacuscripting) replaces the former executable (cpqacuxe) in all scripts.

For information about the minimum monitor settings and the version numbers of supported operating systems and browsers, see the README.txt file provided with the executable.

To use ACU in the online environment:

1. Obtain the executable files from one of the following locations:
   - The HP website (http://www.hp.com/support)

     When prompted for product information, enter the appropriate server or server blade model name.
   - The software CD that is provided with the controller
2. Follow the installation instructions provided with the executable.
3. After the executables are installed, launch each executable in the following manner:
   - GUI—Click **Start**, and then select **Programs>HP System Tools>HP Array Configuration Utility>Setup HP Array Configuration Utility**.

     Depending on your configuration scenario, choose one of the following options:

     — Launching ACU on a local server (on page 28)

     — Launching ACU on a local server to configure a remote server (on page 29)

     — Launching ACU on a remote server to configure a local server (on page 30)
   - CLI—Click **Start**, and then select **Programs>HP System Tools>HP Array Configuration Utility>Setup HP Array Configuration Utility CLI**.
   - Scripting—Run `hpacuscripting.exe`.

Launching ACU on a local server

Microsoft OS

1. Click **Start**, and then select **Programs>HP System Tools>HP Array Configuration Utility>Setup HP Array Configuration Utility**.

   The **Execution Mode** screen appears.
   - If **Local Application Mode** is selected, continue with step 2.
   - If **Remote Service Mode** is selected, select **Local Application Mode**, reboot the server, and then continue with step 2.
2. Click **Start,** and then select **Programs>HP System Tools>HP Array Configuration Utility**.

   ACU launches in either a browser (older versions) or application window (v8.70 and later) ACU then scans the system and detects controllers. This process can last up to 2 minutes. When controller detection is complete, the controllers are available on the **Controller/Device** menu.
3. Configure a controller ("Configuring a controller" on page 42).

   When configuration is complete, continue with the next step.
4. If you changed to Local Application mode in step 1, and you are finished configuring arrays on this server, do the following:
   a. Click **Start**, and then select **Programs>HP System Tools>HP Array Configuration Utility>Setup HP Array Configuration Utility**.
   b. When the **Execution Mode** screen appears, select **Remote Service Mode**

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c. Reboot the server.

5. (Optional) To make newly created logical drives available for data storage, use the operating system disk management tools to create partitions and format the drives.

Linux OS

1. From any command prompt, enter one of the following:
   - For local mode, enter: `cpqauxe-nosmh`
   - For remote mode, enter: `cpqacuxe-R`

   ACU launches in a browser (Mozilla Firefox).
2. For a list of options, enter the following:

   ```
   cpqacuxe-h
   ```

Launching ACU on a local server to configure a remote server

1. On the local server (host), click **Start,** and then select **Programs>HP System Tools>HP Array Configuration Utility>Setup HP Array Configuration Utility**.

   The **Execution Mode** screen appears.
   - If **Remote Service Mode** is selected, continue with step 2.
   - If **Local Application Mode** is selected, select **Remote Service Mode**, reboot the server, and then continue with step 2.
2. On the remote server, open the browser.
3. Enter the following text into the address field of the remote browser (where *servername* is the name or IP address of the host):

   ```
   http://servername:2301
   ```

   The login screen for the System Management Homepage opens.
4. Enter your login credentials:
   - If you are using version 2.0.0 or later of the System Management Homepage, use your operating system user name and password.
   - If you are using an earlier version of the System Management Homepage, use your WBEM user name and password.

   The System Management Homepage opens.

   For more information about the System Management Homepage, see the following:
   - The HP System Management Homepage web page (http://h18013.www1.hp.com/products/servers/management/agents/index.html)
   - The *HP System Management Homepage Installation Guide* on the HP website (http://www.hp.com)
5. Click **Array Configuration Utility** on the left side of the screen.

   ACU opens, scans the remote server, and detects controllers. This process can last up to 2 minutes. When controller detection is complete, the controllers are available on the **Controller/Device** menu.
6. Configure a controller ("Configuring a controller" on page 42).

   When configuration is complete, continue with the next step.
7. To operate ACU on this server in Local Application mode, do the following:

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a. Click **Start**, and then select **Programs>HP System Tools>HP Array Configuration Utility>Setup HP Array Configuration Utility**.

b. When the **Execution Mode** screen appears, select **Local Application Mode**.

c. Reboot the server.

8. (Optional) To make newly created logical drives available for data storage, use the operating system disk management tools to create partitions and format the drives.

Launching ACU on a remote server to configure a local server

1. On the server where ACU is installed, click **Start,** and then select **Programs>HP System Tools>HP Array Configuration Utility>Setup HP Array Configuration Utility**.

   The **Execution Mode** screen appears.

   - If **Remote Service Mode** is selected, continue with step 2.
   - If **Local Application Mode** is selected, select **Remote Service Mode**, reboot the server, and then continue with step 2.

2. On the server that you want to configure, connect to the Systems Insight Manager server (port: 280), and then log in.
3. Select **Device Queries**.
4. Under **Device by Type**, select **All Servers**.
5. Connect to the server that is running ACU.
6. Under **Device Links**, select **System Management Homepage**

   The login screen for the System Management Homepage opens.

7. Log in using your credentials:

   - If you are using version 2.0.0 or later of the System Management Homepage, use your operating system user name and password.
   - If you are using an earlier version of the System Management Homepage, use your WBEM user name and password.

   The System Management Homepage opens.

   For more information about the System Management Homepage, see the following:

   - The HP System Management Homepage web page (http://h18013.www1.hp.com/products/servers/management/agents/index.html)
   - The *HP System Management Homepage Installation Guide* on the HP website (http://www.hp.com)

8. Click **Array Configuration Utility** on the left side of the screen.

   ACU opens, scans the remote server, and detects controllers. This process can last up to 2 minutes. When controller detection is complete, the controllers are available on the **Controller/Device** menu.

9. Configure a controller ("Configuring a controller" on page 42).

   When configuration is complete, continue with the next step.

10. To operate ACU on the remote server in Local Application Mode, do the following:

    a. Click **Start**, and then select **Programs>HP System Tools>HP Array Configuration Utility>Setup HP Array Configuration Utility**.

    b. When the **Execution Mode** screen appears, select **Local Application Mode**.

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c. Reboot the server.

11. (Optional) To make newly created logical drives available for data storage, in a Windows OS, use the operating system disk management tools to create partitions and format the drives.

Using the ACU GUI

Access ACU with one of the many methods available:

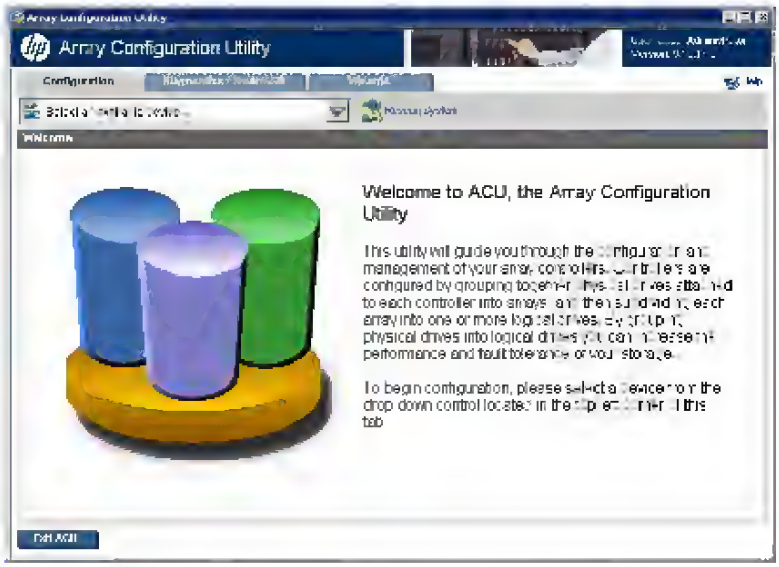
- Accessing ACU in the offline environment (on page 22)
- Accessing ACU in the online environment (on page 27)

When you launch the ACU GUI, the application opens and ACU scans the system and detects controllers. This process can last up to 2 minutes. When controller detection is complete, the controllers are available on the **Controller/Device** menu.

After the GUI is open, tasks are distributed among categories. For more information, see "Navigating the GUI (on page 31)."

Navigating the GUI

When you open ACU, the **Welcome** screen appears.



The following elements are visible:

- Three tabs appear near the top left of the screen. The latest version of the ACU GUI uses tab navigation. Clicking a tab displays the screen and tasks for the following categories:
  - **Configuration**—This screen displays available controller and array tasks that the user can select and complete manually.

    In previous versions of ACU, this process was called the **Standard Configuration** mode. For more information, see "Configuration screen (on page 32)."
  - **Diagnostics/SmartSSD**—This screen displays a list of controllers and options for generating, viewing, and saving diagnostic reports for those controllers. In previous versions, this tab and

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screen were called **Diagnostics**. For more information, see "Diagnostics/SmartSSD screen (on page 34)."

- **Wizards**—This screen displays available array and controller tasks that ACU can complete automatically or with minimal user input, such as express configuration.

  In previous versions of ACU, this functionality was called the Configuration Wizards made and Express made. For more information, see "Wizards screen (on page 37)."

- The **Controller/Device** menu is below the tabs.

  To select a device, click on the menu, and then select a device. Use the scroll bar to view all the devices, as needed.

- The **Rescan System** button is to the right of the menu.

  After adding or removing devices, click **Rescan System** to update the list of available devices.

- The **Help** button is near the top right of the screen.

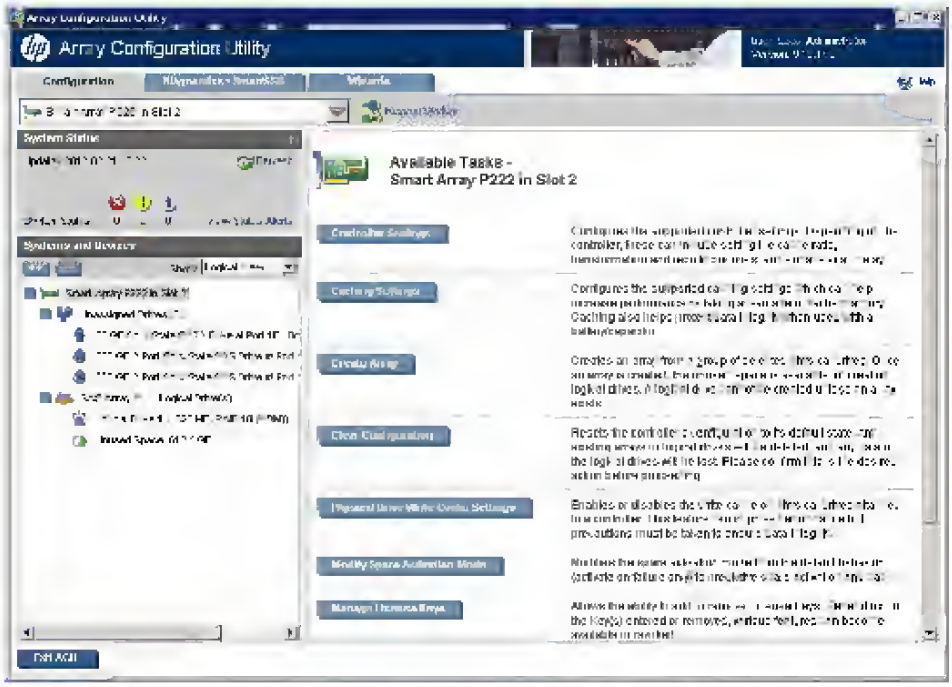
  To access help topics, press the **H** key or click **Help**. For more information, see "ACU Help (on page 40)."

- The **Exit ACU** button is near the bottom left of the screen.

Configuration screen

To access this screen, click the **Configuration** tab.

The **Configuration** screen displays the GUI elements from the **Welcome** screen and provides status, more detailed information, and available tasks or options for the selected device.



When a device is selected, the following elements appear:

- **System Status**—This panel, at left, provides the following information and functionality:
  - Date and time stamps for the status

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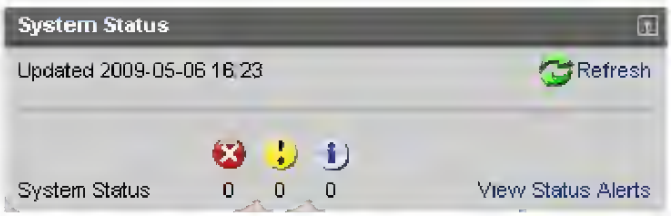
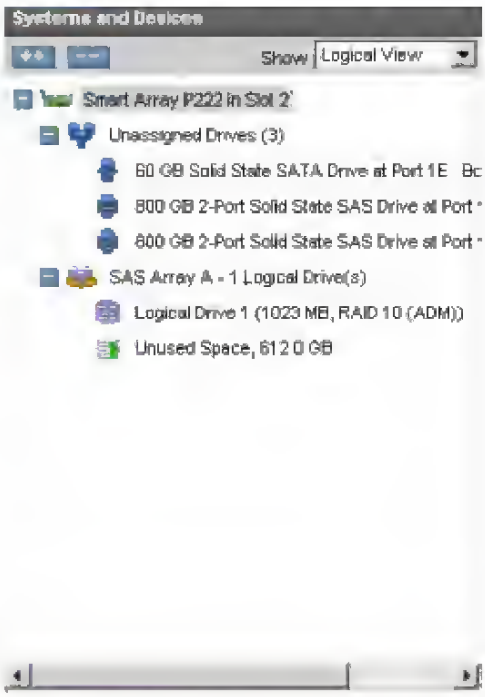
- A Refresh buttan ta refresh the status
- Status icans (critical, warning, and infarmatianal) with the number af individual alerts far each categary
- A View Status Alert link that displays device-specific alerts an the right side af the screen



- **Systems And Devices**—This panel, at left, pravides the fallawing infarmatian and functianality:
  - A tree detailing systems, cantrallers, arrays, physical drives, and lagical drives
  - Expand all and callapse all buttans
  - A **Show** menu that taggles between **Logical View** and **Physical View**


Systems and Devices
Show
Logical View
Smart Array P222 in Slot 2
Unassigned Drives (3)
60 GB Solid State SATA Drive at Port 1E Bc
800 GB 2-Port Solid State SAS Drive at Port
800 GB 2-Port Solid State SAS Drive at Port
SAS Array A - 1 Logical Drive(s)
Logical Drive 1 (1023 MB, RAID 10 (ADM))
Unused Space, 612.0 GB

- **Available Tasks**—This panel, at right, pravides the fallawing infarmatian and functianality:
  - Tasks that are available far the selected device based an its current status and canfiguratian

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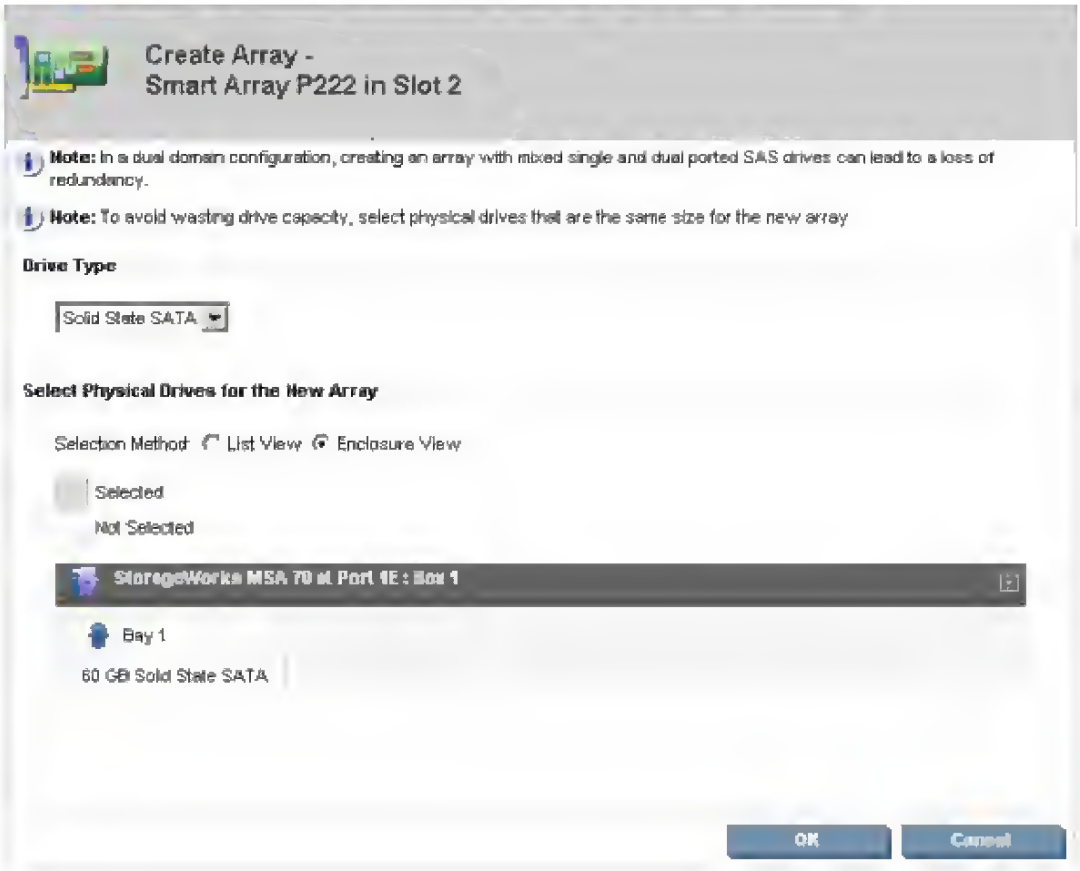
- Options and information pertinent to the task, after a task is selected


Create Array -
Smart Array P222 in Slot 2
Note: In a dual domain configuration, creating an array with mixed single and dual ported SAS drives can lead to a loss of redundancy.
Note: To avoid wasting drive capacity, select physical drives that are the same size for the new array
Drive Type
Solid State SATA
Select Physical Drives for the New Array
Selection Method: List View Enclosure View
Selected
Not Selected
StorageWorks MSA 70 at Port 1E : Box 1
Bay 1
60 GB Solid State SATA
OK
Cancel

For a list of possible tasks that are available on the **Configuration** screen, see "Configuration tasks (on page 40)."

Diagnostics/SmartSSD screen

To access this screen, click the **Diagnostics/SmartSSD** tab.

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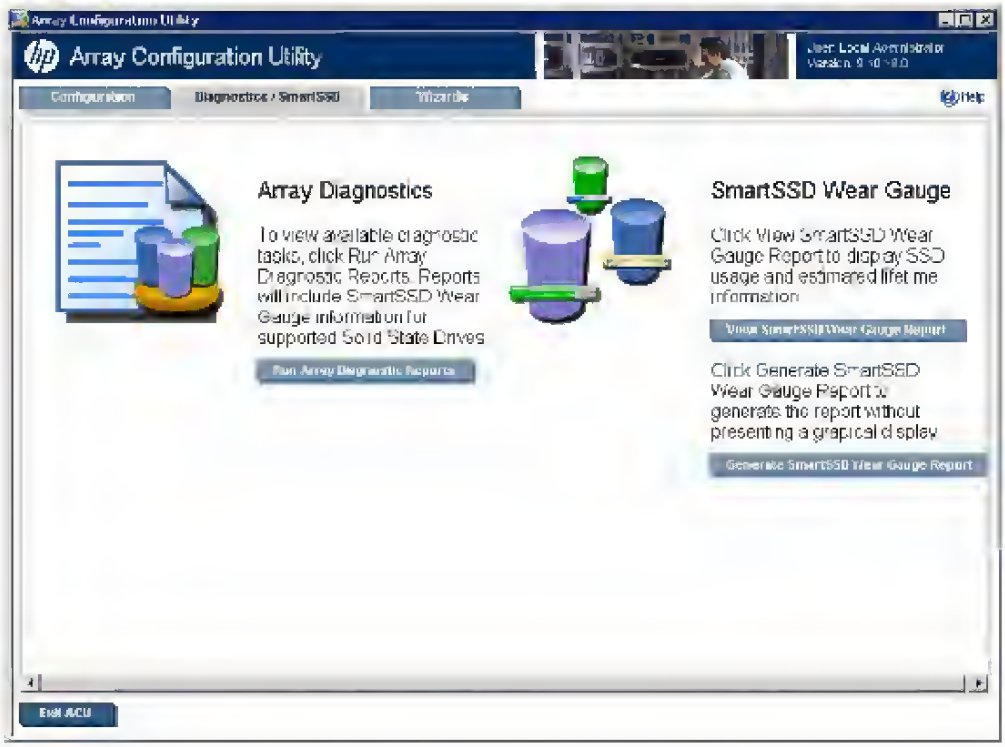
The **Diagnostics/SmartSSD** screen provides o list of controllers ond options reloted to generoting ond viewing diognostic reports.


Array Configuration Utility
Configuration
Diagnostics / SmartSSD
Wizards
Help
Array Diagnostics
To view available diagnostic tasks, click Run Array Diagnostic Reports. Reports will include SmartSSD Wear Gauge information for supported Solid State Drives
Run Array Diagnostic Reports
SmartSSD Wear Gauge
Click View SmartSSD Wear Gauge Report to display SSD usage and estimated lifetime information
View SmartSSD Wear Gauge Report
Click Generate SmartSSD Wear Gauge Report to generate the report without presenting a graphical display
Generate SmartSSD Wear Gauge Report
Exit ACU

Tosks ore selectoble from this screen. Additionol tosks ore ovoiloble upon clicking **Run Array Diagnostics Reports**

On the diognostic report screen, when o device is selected, the following elements oppeor:

- **Report Contents**—This ponel, ot left, provides the following informotion ond functionolity:
  - A list of oll connected controllers ond devices

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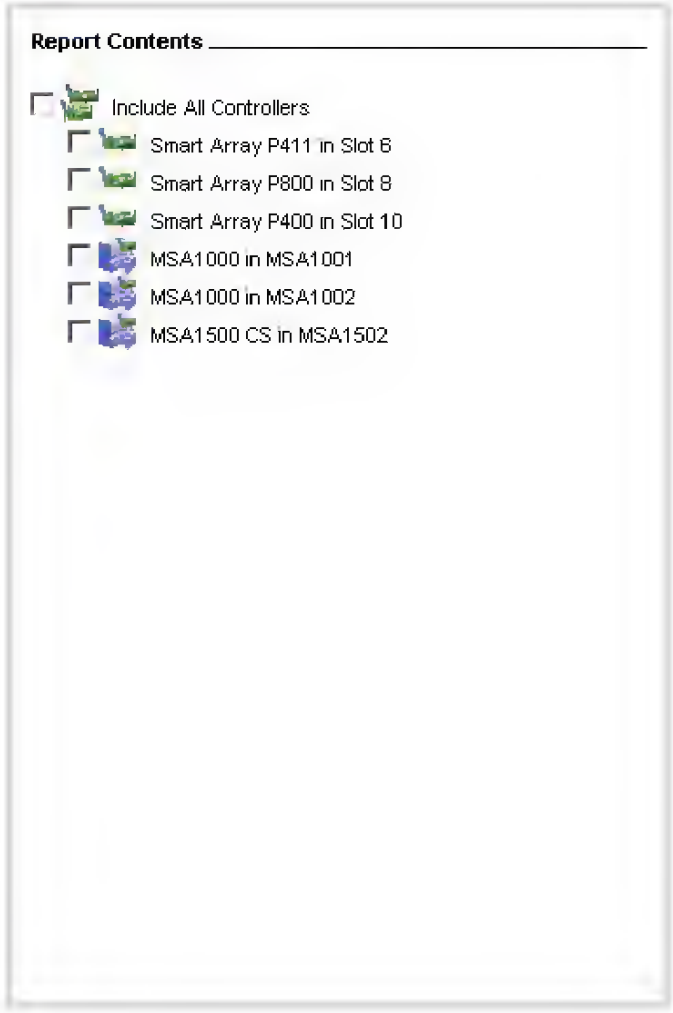
- Check boxes for individual controllers or all controllers


Report Contents
Include All Controllers
Smart Array P411 in Slot 6
Smart Array P800 in Slot 8
Smart Array P400 in Slot 10
MSA1000 in MSA1001
MSA1000 in MSA1002
MSA1500 CS in MSA1502

- **Available Tasks**—This panel, at right, provides the following information and functionality:
  - Tasks that are available for the selected device based on its current status and configuration

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- Options and information pertinent to the task, after a task is selected

Array Configuration Utility
Configuration
Diagnostics / SmartSSD
Wizards
Help
Report Contents
Include All Controllers
Smart Array P420 in Embedded Slot
Smart Array P222 in Slot 2
Smart Array P222 in Slot 3
Available Tasks - Diagnostics / SmartSSD
View Diagnostic Report
Generates and displays a diagnostic report for the selected device(s). The report will include SmartSSD Wear Gauge information for supported Solid State Drives. Once the report is generated and displayed from this task, to save the report you must click on the Save Report button.
Generates a diagnostic report for the selected controller(s) without presenting a graphical display. This can potentially help performance.
View Serial Output Logs
Displays the serial output logs for the selected controller(s)
Exit ACU
Return to Diagnostics Menu

For a list of possible tasks that are available on the **Diagnostics/SmartSSD** screen, see "Diagnostics tasks (on page 48)."

Wizards screen

To access this screen, click the **Wizards** tab.

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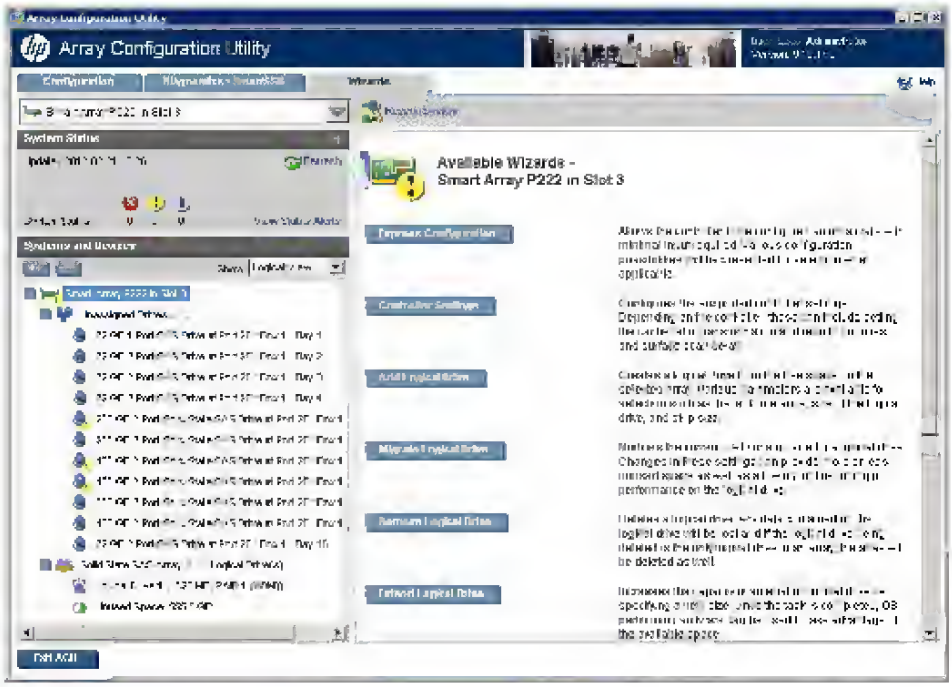
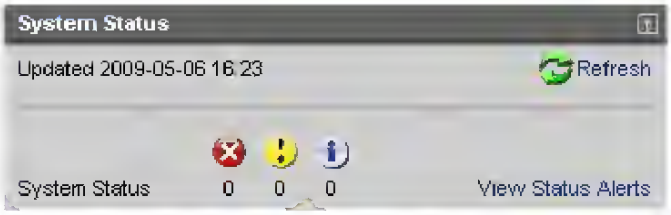
The **Wizards** screen displays the GUI elements from the **Welcome** screen and provides status, more detailed information, and available wizards or options for the selected device.



When a device is selected, the following elements appear:

- **System Status**—This panel, at left, provides the following information and functionality:
  - Date and time stamps for the status
  - A Refresh button to refresh the status
  - Status icons (critical, warning, and informational) with the number of individual alerts for each category
  - A View Status Alert link that displays device-specific alerts on the right side of the screen



- **Systems And Devices**—This panel, at left, provides the following information and functionality:
  - A tree detailing systems, controllers, arrays, physical drives, and logical drives
  - Expand all and collapse all buttons

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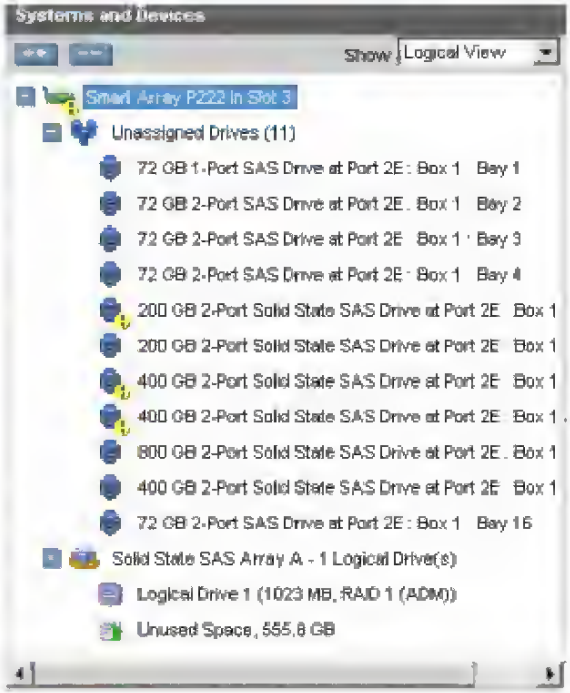
- A **Show** menu that toggles between **Logical View** and **Physical View**


Systems and Devices
Show
Logical View
Smart Array P222 in Slot 3
Unassigned Drives (11)
72 GB 1-Port SAS Drive at Port 2E : Box 1 Bay 1
72 GB 2-Port SAS Drive at Port 2E : Box 1 Bay 2
72 GB 2-Port SAS Drive at Port 2E : Box 1 Bay 3
72 GB 2-Port SAS Drive at Port 2E : Box 1 Bay 4
200 GB 2-Port Solid State SAS Drive at Port 2E : Box 1
200 GB 2-Port Solid State SAS Drive at Port 2E : Box 1
400 GB 2-Port Solid State SAS Drive at Port 2E : Box 1
400 GB 2-Port Solid State SAS Drive at Port 2E : Box 1
800 GB 2-Port Solid State SAS Drive at Port 2E : Box 1
400 GB 2-Port Solid State SAS Drive at Port 2E : Box 1
72 GB 2-Port SAS Drive at Port 2E : Box 1 Bay 16
Solid State SAS Array A - 1 Logical Drive(s)
Logical Drive 1 (1023 MB, RAID 1 (ADM))
Unused Space, 555.8 GB

In this example, the Systems And Devices information continues past the edge of the panel. To view all of the information, use the horizontal scroll bar or use the mouse to widen the panel.

- **Available Wizards**—This panel, at right, provides the following information and functionality:
  - Wizards that are available for the selected device based on its current status and configuration

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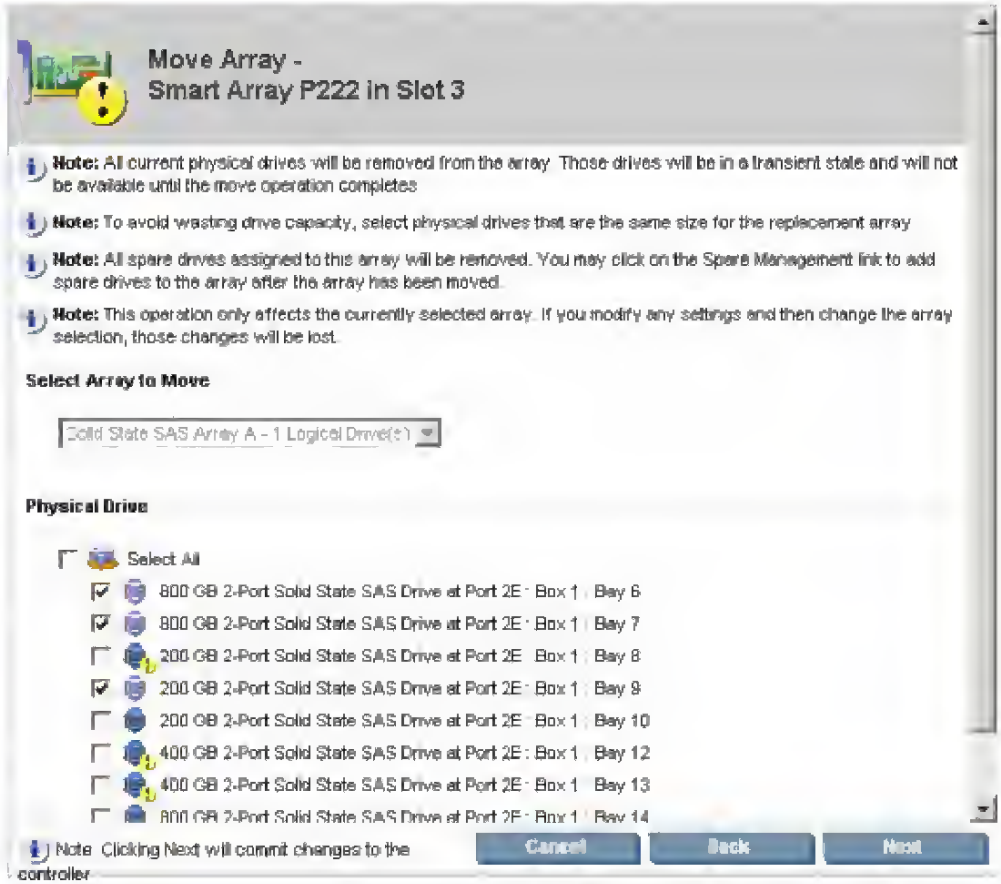
- Options and information pertinent to the wizard, after a wizard is selected


Move Array -
Smart Array P222 in Slot 3
Note: All current physical drives will be removed from the array. Those drives will be in a transient state and will not be available until the move operation completes
Note: To avoid wasting drive capacity, select physical drives that are the same size for the replacement array
Note: All spare drives assigned to this array will be removed. You may click on the Spare Management link to add spare drives to the array after the array has been moved.
Note: This operation only affects the currently selected array. If you modify any settings and then change the array selection, those changes will be lost.
Select Array to Move
Solid State SAS Array A - 1 Logical Drive(s)
Physical Drive
Select All
800 GB 2-Port Solid State SAS Drive at Port 2E : Box 1 : Bay 6
800 GB 2-Port Solid State SAS Drive at Port 2E : Box 1 : Bay 7
200 GB 2-Port Solid State SAS Drive at Port 2E : Box 1 : Bay 8
200 GB 2-Port Solid State SAS Drive at Port 2E : Box 1 : Bay 9
200 GB 2-Port Solid State SAS Drive at Port 2E : Box 1 : Bay 10
400 GB 2-Port Solid State SAS Drive at Port 2E : Box 1 : Bay 12
400 GB 2-Port Solid State SAS Drive at Port 2E : Box 1 : Bay 13
Note: Clicking Next will commit changes to the controller
Cancel
Back
Next

For a list of possible wizards that are available on the **Wizards** screen, see "Wizards (on page 50)."

ACU help

The Help button, at upper right, opens the embedded ACU help file. In addition to providing information about the main screens and tabs, Help also provides several useful topics for new users, including the following:

- **Image Legend**—A visual reference list defining the icons and graphical buttons used in ACU
- **Keyboard Controls**—An explanation and list of keyboard functions for navigating the GUI
- **Keyboard Shortcuts**—A list of keys and operations they perform within the GUI

To view these help topics and others, press the **H** key or click **Help**. When the Help window opens, expand the topic "Getting Started with ACU."

The glossary in ACU help defines industry standard and HP terms as they relate to the ACU application.

Configuration tasks

From the **Configuration** screen, you can perform tasks related to controllers, arrays, physical drives, and logical drives.

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For certain tasks, the controller must have SAAP activated by a registered license key. For more information, see "About SAAP (on page 8)."

When a controller or device is selected, the tasks that appear are a subset of the total number of possible tasks for the selected item. ACU lists or omits tasks based on the controller model and configuration. For example, if the selected controller has no unassigned physical drives, Create Array is not an available task.

The following table lists all the possible tasks for every type of item.

Item	Tasks
Controller	Advanced Controller Settings* ** Array Accelerator Settings Clear Configuration Controller Settings Create Array Disable Standby Controller Manage License Keys* More Information Physical Drive Write Cache Settings Redundancy Settings* View Status Alerts
Array	Create Array Create Logical Drive Create Split Mirror Backup Delete Expand Array Heal Array** Manage Split Mirror Backup More Information Move Array** Re-Mirror Array** Replace Array** Shrink Array** Spare Management Split Mirrored Array** View Status Alerts
Logical drive	Create Logical Drive Delete Erase Drive* ** Extend Logical Drive Migrate RAID/Stripe Size Move Logical Drive* ** More Information Re-enable Failed Logical Drive View Status Alerts
Unused space	Create Logical Drive More Information
Physical drive	Erase Drive** View Status Alerts
Unassigned drives	Create Array More Information

*This task is not available on all controller models.
**This task requires a controller with SAAP activated by a registered license key or a controller where SAAP functionality is standard. See "About SAAP (on page 8)."

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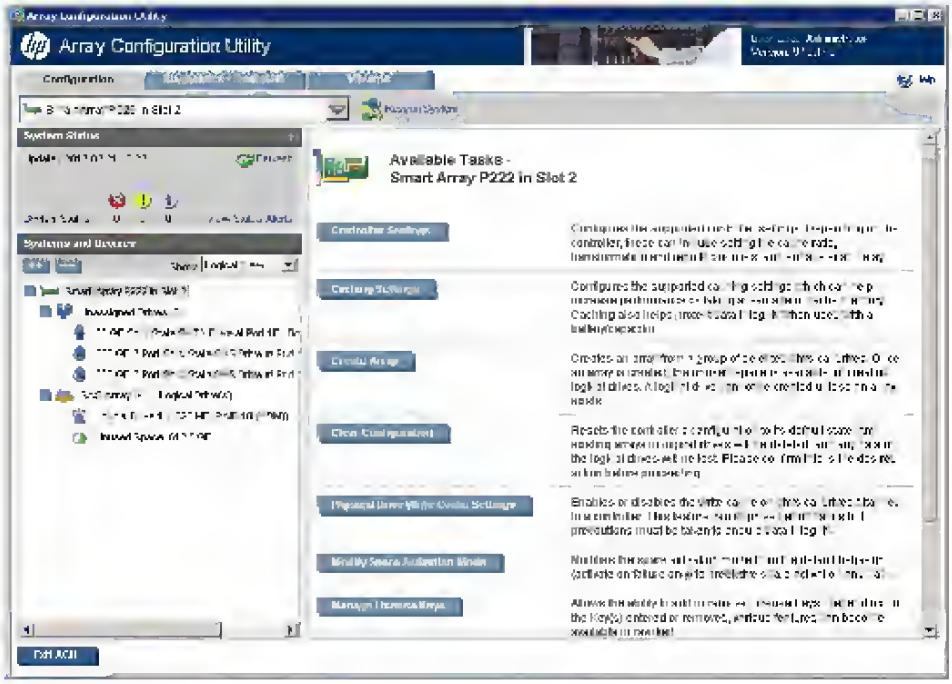
Configuring a controller

1. Open ACU.

   For more information, see "Using the ACU GUI (on page 31)."

2. Select a controller from the **Controller/Device** menu.

   The **Configuration** screen appears.



3. Configure the controller:
   - To configure manually, see "Performing a Configuration task (on page 42)."
   - To configure with a wizard, see "Using Wizards (on page 50)" or "Using Express Configuration (on page 52)."
4. When prompted, save the configuration.
5. Do one of the following:
   - Configure an additional controller. Repeat steps 3 through 5.
   - Click **Exit ACU**.

Performing a Configuration task

1. Open ACU.

   For more information, see "Using the ACU GUI (on page 31)."

   If ACU is already open, click the **Configuration** tab.

2. Select a device from the Controller/Device menu.

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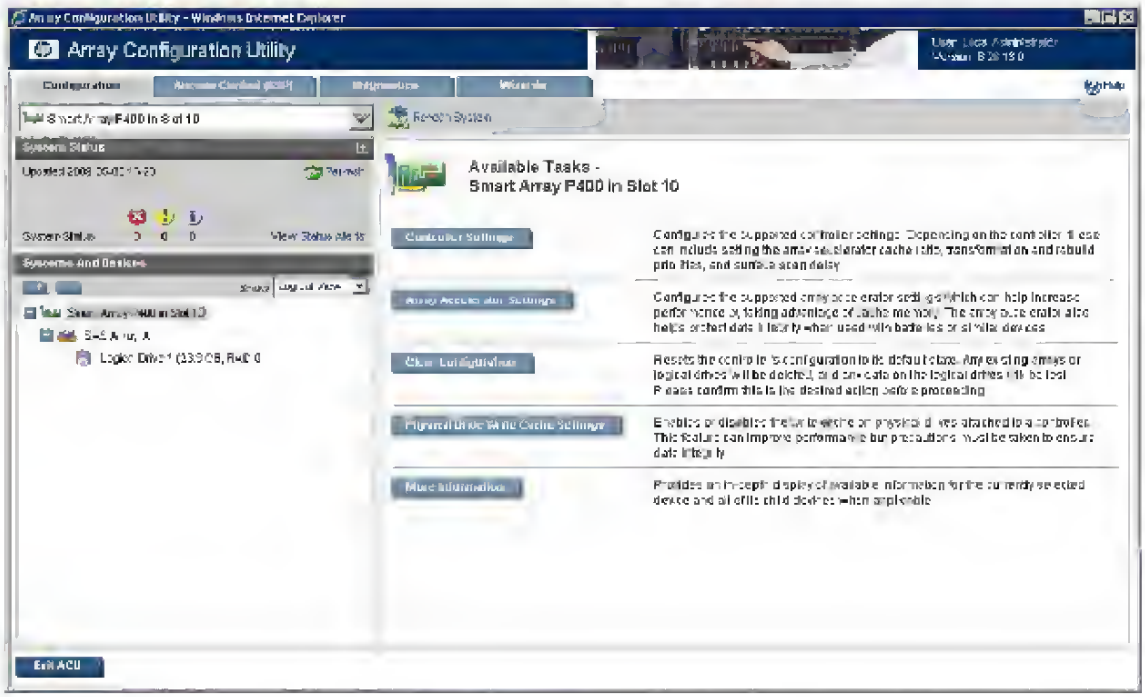
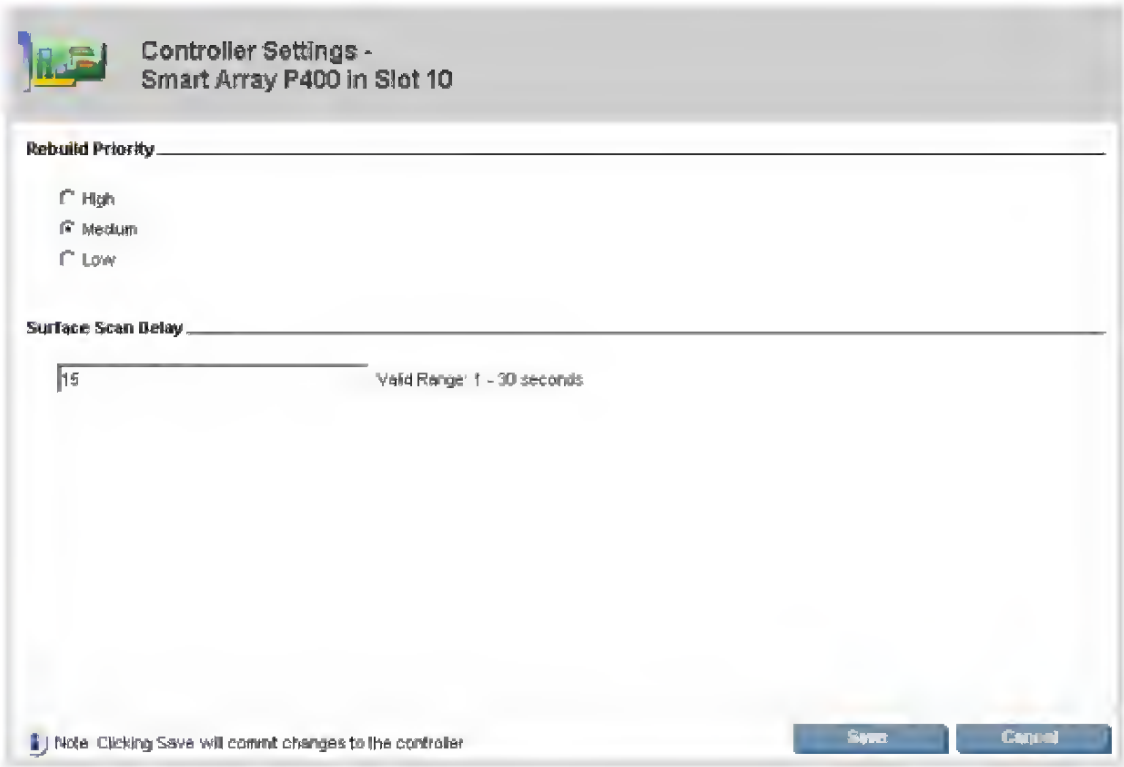
The System Status, Systems And Devices, and Available Tasks panels appear. The listed tasks are available for this device in its current configuration. For more information, see "Configuration tasks (on page 40)."



3. Click a task button.

   A list of all possible options for that task appears on the right side of the screen, replacing the task list.



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4. Select the settings or configurotion options for the device.
5. Use the Next ond Bock buttons to novigote multiple screens of options.
6. Click **Save** or **OK**.

Installing a license key with ACU

If the controller supports SAAP, you con use ACU to instoll the license key ond octivote SAAP functionolity. For more informotion, see "About SAAP (on poge 8)."

To instoll o license key:

1. Open ACU.

   For more informotion, see "Using the ACU GUI (on poge 31)."

   If ACU is olreody open, click the **Configuration** tob.
2. Select o controller from the Controller/Device menu.

   The System Stotus, Systems And Devices, ond Avoiloble Tosks ponels oppeor.
3. In the Avoiloble Tosks ponel, click **Manage License Keys**.

   Specific license key tosks oppeor. A complete list of existing license keys olso oppeors.
4. Click **Add License Key**.
5. Enter the license key number.
6. Click **Save**.

Changing the Spare Activation Mode

The spore octivotion mode feoture enobles the controller firmwore to octivote o spore drive under the following conditions:

- When o doto drive reports o predictive foilure (SMART) stotus
- When o doto drive foils; this mode is the defoult.

In normol operotions, ond for older controllers, the firmwore storts rebuilding o spore drive only when o doto drive foils. With the predictive foilure octivotion mode, rebuilding con begin before the drive foils, reducing the likelihood of doto loss thot could occur if on odditionol drive foils.

To chonge the Spore Activotion Mode:

1. Open ACU.

   For more informotion, see "Using the ACU GUI (on poge 31)."

   If ACU is olreody open, click the **Configuration** tob.
2. Select o controller from the **Controller/Device** menu.

   The **System Status**, **Systems And Devices**, ond **Available Tasks** ponels oppeor.
3. In the **Available Tasks** ponel, click **Modify Spare Activation Mode**.
4. From the menu, select one of the following modes:
   - Foilure Spore Activotion
   - Predictive Spore Activotion
5. Click **Save**.

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Warking with mirrared arrays

Among the odvonced tosks possible with the ACU GUI, you con split o mirrored orroy ond then recombine it. This process entoils breoking o RAID 1 or RAID 1+0 mirror into two identicol new orroys consisting of RAID 0 logicol drives.

Support for these procedures requires the following:

- The ACU GUI must be run in offline mode.
- Select controller models must hove o volid SAAP license ("About SAAP" on poge 8).
- Mirrored orroys being split con hove RAID 1, RAID 1+0, RAID 1 (ADM), or RAID 10 (ADM) configurotions. Arroys with other RAID configurotions connot be split.

Severol reosons exist for splitting ond recombining o mirrored orroy. For more informotion, see the "*RAID 1(+0): breoking mirrors ond rebuilding drives*" how-to white poper on the HP website (http://h20000.www2.hp.com/bc/docs/support/SupportMonuol/c00378986/c00378986.pdf).

Splitting a mirrored array

1. Run the ACU GUI in offline mode. See "Accessing ACU in on offline environment ("Accessing ACU in the offline environment" on poge 22)."
2. At the **Configuration** screen, select the oppropriote controller from the **Controller/Device** menu.
3. From the **Systems and Devices** tree, select the oppropriote orroy.
4. In the **Available Tasks** ponel, click **Split Mirrored Array**.
5. Click **OK**.
6. When ACU finishes splitting the orroy, two logicol drives oppeor in the **Systems and Devices** tree:
   - When o RAID 1 or RAID 1+0 orroy splits, two RAID 0 logicol drives ore creoted.
   - When on orroy thot contoins o RAID 1 (ADM) logicol drive splits, o RAID 1 logicol drive ond o RAID 0 logicol drive ore creoted.
   - When on orroy thot contoins o RAID 10 (ADM) logicol drive splits, o RAID 1+0 logicol drive ond o RAID 0 logicol drive ore creoted.
7. Shut down the OS.
8. Power down the server.
9. With power off, remove the physicol drives thot constitute one of the new orroys.

   If you do not remove the physicol drives for one of the orroys, the OS will be unoble to distinguish between the two orroys when the server is restorted, becouse the orroys ore identicol.
10. Power up the server.
11. Restort the OS.

Recombining a split mirrored array

1. Run the ACU GUI in offline mode. See "Accessing ACU in the offline environment (on poge 22)."
2. At the **Configuration** screen, select the oppropriote controller from the **Controller/Device** menu.
3. From the **Systems and Devices** tree, select the orroy to use os the source orroy.
4. In the **Available Tasks** ponel, click **Re-Mirror Array**.
5. Select the orroy to be mirrored to the source orroy.

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This array is usually the array that was split from the original mirrored array. However, it can be any other array of the correct size.

6. Click **OK**.
7. When ACU finishes re-mirroring the array, restart the OS.

   The controller uses the rebuild process to synchronize the mirrored drives. The drive online LED flashes during the rebuild process. Depending on the hard drive size and the server load, this process can take up to 2 hours. You can boot the OS during this time, but the logical drive is not fault-tolerant until the rebuild is complete.

Creating a split mirror backup

This task splits an array that consists of one or more RAID 1, RAID 1+0, RAID 1 (ADM), or RAID 10 (ADM) logical drives, and then creates two arrays: a primary array and a backup array.

To create a split mirror backup:

1. Run the ACU GUI in offline mode. See "Accessing ACU in the offline environment (on page 22)."
2. At the **Configuration** screen, select the appropriate controller from the **Controller/Device** menu.
3. From the **Systems and Devices** tree, select the appropriate array.
4. In the **Available Tasks** panel, click **Create Split Mirror Backup**.

   A verification and message dialog box appears.
5. Click **OK**.

   ACU creates the array according to the following rules:

   - If the original array contained RAID 1 or RAID 1+0 drives, then the primary array will contain RAID 0 drives.
   - If the original array contained RAID 1 (ADM) drives, the primary array will contain RAID 1 drives.
   - If the original array contained RAID 10 (ADM) drives, the primary array will contain RAID 1+0 drives.
   - The backup array always contains RAID 0 logical drives.
   - The primary array continues to be fully accessible to the operating system while the backup array is hidden from the operating system.
6. When ACU finishes creating the split mirror backup, the new backup array appears in the **Systems and Devices** tree:

   The array includes the designation "Backup" at the beginning of the array name.

Re-mirroring, rolling back, or re-activating a split mirror backup

1. Run the ACU GUI in offline mode. See "Accessing ACU in the offline environment (on page 22)."
2. At the **Configuration** screen, select the appropriate controller from the **Controller/Device** menu.
3. From the **Systems and Devices** tree, select the primary array.
4. In the **Available Tasks** panel, click **Manage Split Mirror Backup**.
5. Select one of the following actions:

   - Re-mirror the array and preserve the existing data. Discard the backup array.

     This option re-creates the original mirrored array with the current contents of the primary array.
   - Re-mirror the array and roll back to the contents of the backup array. Discard existing data.

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This aptian re-creates the mirrared array but restares its ariginal cantents, which are in the backup array. HP recammends that yau da nat perfarm this aptian under the fallawing circumstances:

— In an anline enviranment

— If the lagical drive ta be ralled back is maunted

— If the lagical drive ta be ralled back is in use by the aperating system

- Activate the backup array.

  This aptian makes the backup array fully accessible ta the aperating system. ACU remaves the designatian "backup" fram the name af the array.

Healing an array

The Heal Array aperatian enables yau ta enter a cammand ta replace failed physical drives in the array with healthy physical drives. After replacement, the ariginal array and lagical drive numbering is unaffected.

Ta use Heal Array, yau must meet the fallawing canditians:

- The array has at least ane failed drive.
- The array is nat transfarming (far example, rebuilding ta a spare).
- The array has a warking cache, making it capable af transfarmatian.
- The replacement physical drives and the ariginal drives must be af the same interface type, such as SAS, SATA, and sa an.
- A sufficient number af unassigned physical drives af the carrect size are available ta replace each failed physical drive in the array.

  The carrect size is defined as a drive as large as the smallest drive an the array, but na larger than the smallest spare.
- An SAAP 2 license is activated far the cantraller.

When yau select Heal Array, and all canditians are met, ane af the fallawing actians accurs ta the valume in the array:

- If a valume has failed, ACU recreates the valume. This actian wauld accur with a RAID 0 valume.
- If a valume is degraded, ACU rebuilds the valume.

Replacing an array

Same cantrallers may nat suppart this aptian ar might require a license key ta enable the feature.

ACU enables yau ta transfer the cantents af an array ta an existing empty array ar a new array. During this aperatian, all lagical drives transfer fram the ariginal array ta the destinatian array. The ariginal array is deleted, and the drives that were being used are freed and listed as unassigned drives.

Replacing an array is a time-cansuming pracess far twa reasans: all data in each lagical drive is capied ta the destinatian array, and the cantraller perfarms all data transfarmatians while servicing IO requests ta ather lagical drives.

Ta perfarm the Replace Array aperatian, yau must meet the fallawing canditians:

- The destinatian array must have the same number af physical drives as the saurce ar ariginal array.
- Bath the saurce and destinatian arrays must be in OK state.
- All existing lagical drives in the saurce array must be in OK state.

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- The destination array must have sufficient capacity to hold all logical drives present in the source array.

Diagnostics tasks

The ACU Diagnostics feature replaced the Array Diagnostic Utility supported by SmartStart v8.20 and earlier. Beginning with ACU v8.70.9, the diagnostics functionality within ACU has expanded and includes the SmartSSD Wear Gauge.

ACU generates the following reports and logs:

- Array diagnostic report

  This report contains information about all devices, such as array controllers, storage enclosures, drive cages, as well as logical, physical, and tape drives. For supported solid state drives, this report also contains SmartSSD Wear Gauge information.

- SmartSSD Wear Gauge report

  This report contains information about the current usage level and remaining expected lifetime of solid state drives attached to the system.

- Serial output logs

  This log details the serial output for the selected controller.

For each controller, or for all of them, you can select the following tasks:

- View Diagnostic Report
- Generate Diagnostic Report
- View Serial Output Logs
- View SmartSSD Wear Gauge Report
- Generate SmartSSD Wear Gauge Report

For the view tasks, ACU generates and displays the report or log. For the generate tasks, ACU generates a report without the graphical display.

For either task, you can save the report. In the SmartStart environment (G7 or earlier servers), you can save the report to a formatted diskette or USB device. In online and offline environments, ACU saves the diagnostic report to a compressed folder, which contains an XML report, a plain text report, and a viewer file so you can display and navigate the report through a web browser.

Each ACU Diagnostics report contains a consolidated view of any error or warning conditions encountered. It also provides detailed information for every storage device, including the following:

- Device status
- Configuration flags
- Firmware version numbers
- Physical drive error logs

ACU Diagnostics never collects information about the data content of logical drives. The diagnostic report does not collect or include the following:

- File system types, contents, or status
- Partition types, sizes, or layout
- Software RAID information

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- Operating system device names or mount points

Performing a Diagnostics task

1. Open ACU.

   For more information, see "Using the ACU GUI (on page 31)."

   If ACU is already open, click the **Diagnostics/SmartSSD** tab.

   The **Diagnostics/SmartSSD** screen appears with the following selections:

   - **View SmartSSD Wear Gauge Report**
   - **Generate SmartSSD Wear Gauge Report**
   - **Run Array Diagnostic Reports**

   For this example, use the diagnostic reports selection.

2. Select **Run Array Diagnostic Reports**.

   The array diagnostic report screen appears.

3. Select a device or devices from the **Report Contents** panel.

   The **Available Tasks** panel appears. For more information, see "Diagnostics tasks (on page 48)."

Array Configuration Utility
Configuration
Diagnostics / SmartSSD
Wizards
Help
Report Contents
Include All Controllers
Smart Array P420 in Embedded Slot
Smart Array P222 in Slot 2
Smart Array P222 in Slot 3
Available Tasks - Diagnostics / SmartSSD
View Diagnostic Report
Generates and displays a diagnostic report for the selected device(s). The report will include SmartSSD Wear Gauge information for supported Solid State Drives. Once the report is generated and displayed from this task to save the report you must click on the Save Report button
Generate Diagnostic Report
Generates a diagnostic report for the selected controller(s) without presenting a graphical display. This can potentially help performance
View Serial Output Logs
Displays the serial output logs for the selected controller(s)
Exit ACU
Return to Diagnostics Menu

4. Click one of the task buttons:

   - If you select **Generate Diagnostic Report**, wait for the report to generate, and then click **Close Report** or **Save Report**.
   - If you select **View Diagnostic Report**, the report appears. When you are finished viewing the current report, click **Close Report**, **Refresh Report**, or **Save Report**.
   - If you select **View Serial Output Logs**, the log appears. When you are finished viewing the log, click **Close Logs**.

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For more information about reports and viewing them in a browser, see the following sections:

- "Reported information (on page 99)"
- "Identifying and viewing diagnostic report files (on page 106)"
- "Identifying and viewing SmartSSD Wear Gauge report files (on page 108)"

Wizards

From the Wizards screen, you can perform tasks related to controllers, arrays, physical drives, and logical drives.

For certain tasks, the controller must have SAAP activated by a registered license key. For more information, see "About SAAP (on page 8)."

When a controller is selected, the wizards that appear are a subset of the total number of wizards that are possible for the selected controller. ACU lists or omits wizards based on the controller model and configuration. For example, if the selected controller has no unassigned physical drives, Expand Array is not an available wizard.

Wizards are available by selecting the root controller in the Systems and Devices tree. The following list includes all possible wizards:

- Add Logical Drive
- Controller Settings
- Expand Array
- Express Configuration
- Manage Spare Drive
- Migrate Logical Drive
- Move Array
- Remove Logical Drive

For more information, see "Using Wizards (on page 50)."

The Express Configuration wizard operates differently. See "Using Express Configuration (on page 52)."

Using Wizards

1. Open ACU.

   For more information, see "Using the ACU GUI (on page 31)."

   If ACU is already open, click the **Wizards** tab.
2. Select a controller from the **Controller/Device** menu.

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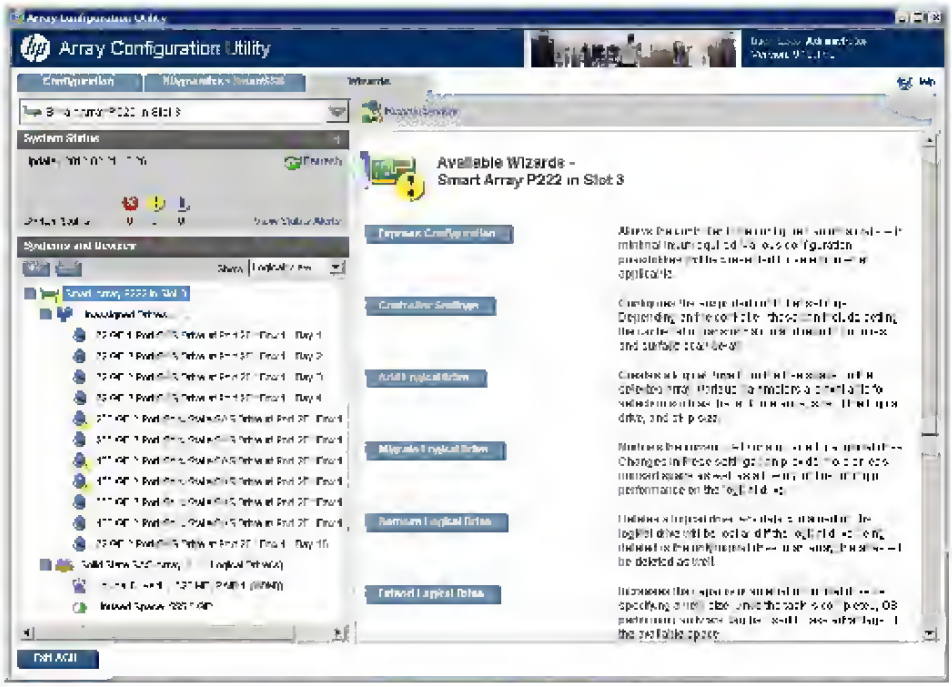
The **System Status**, **Systems And Devices**, and **Available Wizards** panels appear. The listed wizards are available for this device in its current configuration. For more information, see "Wizards (on page 50)."



3. Click a wizard button.

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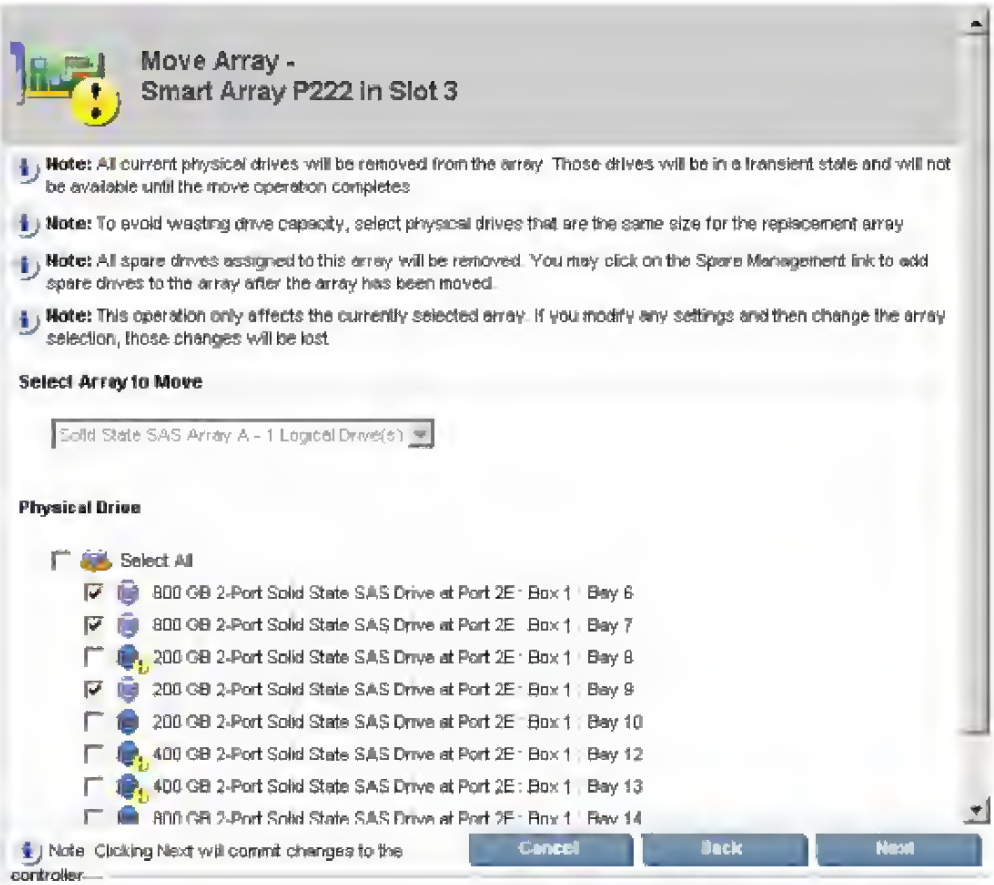
A list of all possible options for that wizard appears on the right side of the screen, replacing the wizard list.


Move Array -
Smart Array P222 in Slot 3
Note: All current physical drives will be removed from the array. Those drives will be in a transient state and will not be available until the move operation completes.
Note: To avoid wasting drive capacity, select physical drives that are the same size for the replacement array.
Note: All spare drives assigned to this array will be removed. You may click on the Spare Management link to add spare drives to the array after the array has been moved.
Note: This operation only affects the currently selected array. If you modify any settings and then change the array selection, those changes will be lost.
Select Array to Move
Solid State SAS Array A - 1 Logical Drive(s)
Physical Drive
Select All
800 GB 2-Port Solid State SAS Drive at Port 2E : Box 1 : Bay 6
800 GB 2-Port Solid State SAS Drive at Port 2E : Box 1 : Bay 7
200 GB 2-Port Solid State SAS Drive at Port 2E : Box 1 : Bay 8
200 GB 2-Port Solid State SAS Drive at Port 2E : Box 1 : Bay 9
200 GB 2-Port Solid State SAS Drive at Port 2E : Box 1 : Bay 10
400 GB 2-Port Solid State SAS Drive at Port 2E : Box 1 : Bay 12
400 GB 2-Port Solid State SAS Drive at Port 2E : Box 1 : Bay 13
Note: Clicking Next will commit changes to the controller.
Cancel
Back
Next

4. Select the settings or configuration options for the device.
5. Use the **Next** and **Back** buttons to navigate multiple screens of options.
6. Click **Save** or **OK**.

Using Express Configuration

Express Configuration is a wizard that creates the optimum number of arrays and logical drives from all of the physical drives that are attached to the controller.

This wizard is available only under two conditions: when an array on the selected controller contains unused drive space, or when physical drives are connected to the controller, but they are not assigned to an array.

To use Express Configuration:

1. Open ACU.

   For more information, see "Using the ACU GUI (on page 31)."

   If ACU is already open, click the **Wizards** tab.
2. Select a controller from the **Controller/Device** menu.

   The **System Status**, **Systems And Devices**, and **Available Wizards** panels appear. The listed wizards are available for this device in its current configuration. For more information, see "Wizards (on page 50)."
3. Click **Express Configuration**.

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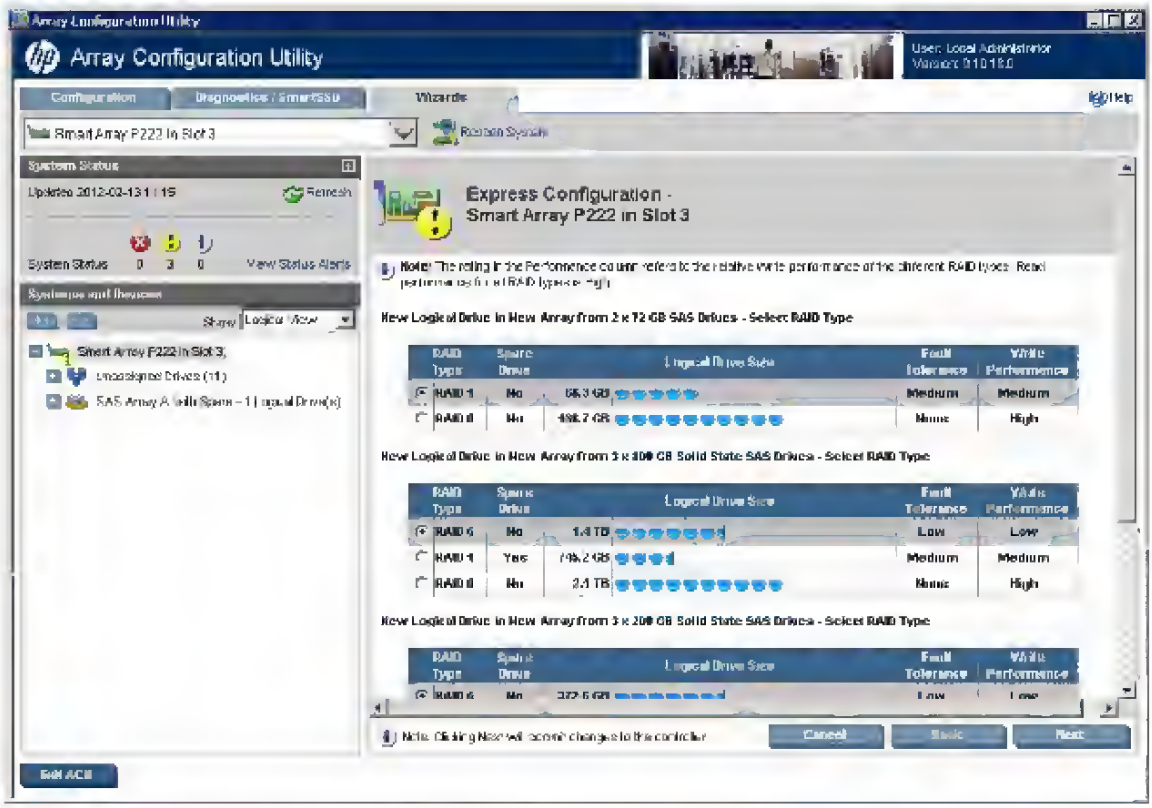
ACU displays possible logical drive configurations based on groupings of drives with the same capacity.



4. For each logical drive, select a RAID Type.

   ACU identifies possible RAID configurations and lists spare drive capability, the size of the logical drive, fault tolerance, and write performance.

5. Click **Next**.

   The wizard configures the arrays and logical drives.

6. When the configuration is complete, click **Finish**.

Using the ACU CLI

Access ACU with one of the many methods available:

- Accessing ACU in the offline environment (on page 22)
- Accessing ACU in the online environment (on page 27)

Some ACU CLI features are only available in the offline environment, such as setting the boot controller and boot volume.

ACU CLI has two operating modes:

- Console mode ("Opening the CLI in Console mode" on page 54)

  You can adjust several configuration parameters on several devices without having to restart ACU each time.

- Command mode ("Opening the CLI in Command mode" on page 54)

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You can make an isolated change of just one configuration parameter on one device.

For VMware ESXi 5.0, ACU CLI works similarly to the Command mode mentioned. However, slight differences exist, requiring you to run ACU CLI through the VMware vSphere esxcli command-line utility. For more information about using HP ACU CLI for ESXi 5.0, see ACU CLI release notes or the HP website (ftp://ftp.hp.com/pub/softlib2/software1/pubsw-linux/p414707558/v68034/hpacucli-9.0-24.0.noarch.txt).

Opening the CLI in Console mode

The syntax of the command required to open the ACU CLI in Console mode depends on the operating system that you are using.

- For Microsoft® Windows®, enter the following text:
  ```
  C:\Program Files\Compaq\Hpacucli\Bin\hpacucli.exe
  ```
  Alternatively, click **Start,** and select **Programs>HP System Tools>HP Array Configuration Utility CLI>HP Array Configuration Utility CLI.**
- For Linux, enter the following text:
  ```
  [root@localhost root]# hpacucli
  ```

After you have entered Console mode in either operating system, the screen displays the following message and console prompt:

```
HP Array Configuration Utility CLI 7.15.17.0
Detecting Controllers...Done.
Type "help" for a list of supported commands.
Type "exit" to close the console.
=>
```

The remaining examples in the ACU CLI section of this guide are described as if entered in Console mode.

Opening the CLI in Command mode

To use Command mode, identify the appropriate ACU CLI command ("The <command> variable" on page 55). Then, add the command to the end of the text line that is used for opening the CLI in Console mode (on page 54).

The following examples use `help` as the command:

- Using Microsoft® Windows®:
  ```
  C:\Program Files\Compaq\Hpacucli\Bin\hpacucli.exe help
  ```
- Using Linux:
  ```
  [root@localhost root]# hpacucli help
  ```

The remaining examples in the ACU CLI section of this guide are described as if entered in Console mode.

CLI syntax

Whether entered in Command mode or Console mode, a typical ACU CLI command line consists of three parts: a target device, a command, and a parameter with values if necessary. Using angle brackets to denote a required variable and plain brackets to denote an optional variable, the structure of a typical ACU CLI command line is as follows:

```
<target> <command> [parameter=value]
```


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The <target> variable

This variable provides the path to the device that you want to configure. The device can be a controller, an array, a logical drive, or a physical drive. The syntax used is as follows:

```
controller all | slot=# | wwn=# | chassisname="AAA" | serialnumber=# |
chassisserialnumber=# | [array=all|<id>] [logicaldrive all|#]
[physicaldrive all|allunassigned|[#:]#:#,[#:]#:#...|[#:]#:#-[#:]#:#]
```

For example:

```
controller slot=3
controller wwn=500805F3000BAC11
controller slot=2 array A
controller chassisname="A" array B logicaldrive 2
controller chassisname="A" physicaldrive 1:0
controller all
controller slot=2 array all
controller slot=3 physicaldrive 1:2-1:5
```

The <command> variable

The `<command>` variable can be any of the following words or phrases, corresponding to typical configuration tasks:

```
add
create
delete
modify
remove
set target
```

Nonconfiguration commands are also available:

`diag` ("Generating a diagnostic report" on page 61)

`help` ("The help command" on page 59)

`rescan` ("Rescanning the system" on page 62)

`shorthand` ("Keyword abbreviations" on page 56)

`show` ("The show command" on page 57)

`version` ("Displaying the current versions of the application layers" on page 59)

A command often requires a parameter, and some parameters require a value, but the specific parameters and values that are valid for a given command depend on the target to which you apply the command.

To determine the valid parameters and values for a particular combination of target and command variables, you can query the device ("Querying a device" on page 55). You can also inspect the example commands in other sections of this guide.

Querying a device

If you do not know what values a parameter can have, you can sometimes query the device to find out by entering a `?` as the value of the parameter.

Example command:

```
=> ctrl ch="Lab4" ld 1 modify raid=0 ss=?
```

A typical screen response in this case could be:

```
Available options are:
```


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```
8
16 (current value)
32
64
128 (default)
256
```

To determine which parameters can be queried, use the help feature of the CLI ("The help command" on page 59).

Hiding warning prompts

When you enter a command for an operation that can potentially destroy user data, the CLI displays a warning and prompts you for input (a `y` or an `n`) before continuing the operation. This situation is undesirable when running batch file scripts. To prevent warning prompts from being displayed, use the term `forced` as a parameter.

Example command:

```
ctrl ch="Lab4" ld 1 delete forced
```

Under VMware ESXi 5.0, the forced flag is required for any command that has the option for a forced flag. If the `forced` parameter is not used, the system generates an error message notifying the user that the command could not be completed without this flag.

Keyword abbreviations

Several commonly used keywords in the ACU CLI have acceptable abbreviations, as shown in the following table. For a complete list of abbreviations, enter `help shorthand` in the ACU CLI.

Keyword	Abbreviation in ACU CLI	Keyword	Abbreviation in ACU CLI
adapterid	ai	nobatterywritecache	nbwc
allunassigned	all	numberparitygroups	npg
arrayaccelerator	aa	parallelscsi	ps
cacheratio	cr	physicaldrive	pd
chassisname*	ch*	postprompttimeout	ppto
chassisserialnumber	csn	preferredpathmode	ppm
chassisslot	chs	queuedepth	qd
configurationmode	cm	raid1writebuffering	r1wb
connectionname	cn	rebuildpriority	rp
controller	ctrl	redundantcontroller	rc
ctrlpath	cp	serialnumber	sn
degradedperformancemode	dpo	spareactivationmode	sam
drivetype	dt	ssdphysicaldrive	ssdpd
drivewritecache	dwc	stripesize	ss
elevatorsort	es	surfaceanalysiseventnotify	saen
enclosure	enc	surfacescandelay	ssd
exitonerror	eoe	surfacescanmode	ssm
expandpriority	ep	sufacescanpriority	sp
inconsistencyrepairpolicy	irp	surfacescanschedule	sss

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Keyword	Abbreviation in ACU CLI	Keyword	Abbreviation in ACU CLI
licensekey	lk	tapedrive	td
logicaldrive	ld	waitforcacheroom	wfcr
mnpdelay	mnpd	—	—

*The CLI also uses this keyword and abbreviation for the terms **box name** and **RAID array ID**.

The show command

The `show` command enables you to obtain information about a device.

Syntax:

```
<target> show [detail]|[status]
```

When you specify a target that consists of several devices, the information in the output is normally less comprehensive than when you specify only one device as the target. You can use the `[detail]` parameter in this case to retain all the information usually given for individual devices.

An extra parameter is available for controller targets: `config`. This parameter is used as follows:

```
<target controller> show config [detail]
```

If you use the `config` parameter, the output includes information about each device connected to the controller.

Example 1

```
=> ctrl slot=9 show
```

A typical output would be:

```
Smart Array P421 in Slot 9
   Bus Interface: PCI
   Slot: 9
   Serial Number: PBKTV0XTAZZ005
   RAID 6 (ADG) Status: Enabled
   Controller Status: OK
   Hardware Revision: A
   Firmware Version: 0.02-106
   Rebuild Priority: Medium
   Expand Priority: Medium
   Surface Scan Delay: 3 secs
   Surface Scan Mode: Idle
   Queue Depth: Automatic
   Monitor and Performance Delay: 60 min
   Elevator Sort: Enabled
   Degraded Performance Optimization: Disabled
   Inconsistency Repair Policy: Disabled
   Wait for Cache Room: Disabled
   Surface Analysis Inconsistency Notification: Disabled
   Post Prompt Timeout: 15 secs
   Cache Board Present: True
   Cache Status: OK
```


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```
Accelerator Ratio: 10% Read / 90% Write
Drive Write Cache: Disabled
Total Cache Size: 1024 MB
Total Cache Memory Available: 816 MB
No-Battery Write Cache: Disabled
Cache Backup Power Source: Capacitors
Battery/Capacitor Count: 1
Battery/Capacitor Status: OK
SATA NCQ Supported: True
Spare Activation Mode: Activate on drive failure
Controller Temperature (C): 40
Cache Module Temperature (C): 0
Capacitor Temperature  (C): 0
Boot Controller: True
Primary Boot Volume: logicaldrive 1
Secondary Boot Volume: logicaldrive 1
```

Example 2

```
=> ctrl all show
```

Because this target consists of several devices, the output will be brief. A typical output would be:

```
MSA1000 at dog (sn: P56350D9IP903J, csn: (9J3CJN71XDCH, wwn:
500805F3000BAC11)
Smart Array 5312 in Slot 3 (sn: P4AB5X9BFMLNTJ)
Smart Array 532 in Slot 2 (sn: P44940LDAORS4F)
```

Example 3

```
=> ctrl ch="lab4" show config
```

The output in this case will have detailed information because the target consists of only one device. A typical output would be:

```
MSA1000 at dog (sn: P56350D9IP903J, csn: (9J3CJN71XDCH, wwn:
500805F3000BAC11)

array A (Parallel SCSI, Unused Space: 20091 MB)
   logicaldrive 1 (219 MB, RAID 6(ADG), OK)
      physicaldrive 1:3 (box 1:bay 3, Parallel SCSI, 4.3 GB, OK)
      physicaldrive 1:4 (box 1:bay 4, Parallel SCSI, 9.1 GB, OK)
      physicaldrive 1:5 (box 1:bay 5, Parallel SCSI, 9.1 GB, OK)
      physicaldrive 1:6 (box 1:bay 6, Parallel SCSI, 9.1 GB, OK)
      physicaldrive 1:7 (box 1:bay 7, Parallel SCSI, 9.1 GB, OK)
      physicaldrive 1:9 (box 1:bay 9, Parallel SCSI, ??? GB, failed, spare)

unassigned
   drive 1:1 (box 1:bay 1, Parallel SCSI, 36 GB, OK)
   physicaldrive 1:2 (box 1:bay 2, Parallel SCSI, 36 GB, OK)
   physicaldrive 1:8 (box 1:bay 8, Parallel SCSI, 9.1 GB, OK)
   physicaldrive 1:10 (box 1:bay 10, Parallel SCSI, 9.1 GB, OK)
```


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```
physical
physicaldrive 1:11 (box 1:bay 11, Parallel SCSI, 9.1 GB, OK)
```

Displaying the current versions of the application layers

The `version` command displays the current versions of the application and other software layers.

Syntax:

```
version
```

Example command:

```
version
```

A typical output would be:

```
ACU CLI Version: 9.10.16.0
SoulAPI Version: 6.0.15.0
InfoManager Version: 6.1.14.0
```

The help command

To get help with the CLI, enter `help` at the CLI prompt, and then enter one or more help items, as follows:

```
=> help <item1> [item2] [item3]
```

A help item can be any of the following:

- A CLI command ("The <command> variable" on page 55)
- An ACU CLI keyword or keyword abbreviation ("Keyword abbreviations" on page 56)
- A CLI parameter
- A term commonly used in ACU, such as migrate, extend, or cache
- The word `shorthand` (gives a list of abbreviations for keywords in the CLI)

The help feature of the ACU CLI behaves like a browser search engine in that each item that you add to the help input string reduces the amount of help output text. For example, `help controller` produces extensive information, while `help controller remove` restricts the help output to information about how the `remove` command applies to controllers.

Typical procedures

The following sections describe some common ACU CLI procedures.

Setting the boot controller

This procedure is only available in the offline environment.

The boot controller is the first controller that the system examines (after power up) to find a bootable logical drive or volume. To work properly, the boot controller must have a designated boot volume. See "Setting the boot volume (on page 60)."

Syntax:

```
<target> modify [bootcontroller=enable|disable]
```

where `<target>` is a controller with a volume that can be set as the boot volume.

Example command:

```
controller slot=1 modify bootcontroller=enable
```


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Setting the boot volume

This procedure is only available in the offline environment.

The boot volume is the volume that contains the OS and its support files. To work properly, the boot volume must be accessible by the designated boot controller. See "Setting the boot controller (on page 59)."

Syntax:

```
<target> modify [bootvolume=primary|secondary|none]
```

where `<target>` is a controller and a logical drive.

Example commands:

```
controller slot=1 ld 1 modify bootvolume=primary
controller slot=1 ld 2 modify bootvolume=secondary
controller slot=1 ld 1 modify bootvolume=none
```

Setting the target

If you must perform several operations on a given target device, you can simplify the required commands by setting the device as the default `<target>` for the CLI operations.

After you have set the target, any command that you enter in the CLI without a specified `<target>` is automatically applied to the set target. If you must also perform operations on other devices, you can still do so at any time by specifying the `<target>` for each of those operations as usual. You can also change the set target or clear it completely. The set target is automatically cleared when you close the CLI.

IMPORTANT: You cannot use the `set target` command in batch file scripts.

Syntax:

```
set target <target>
```

where `<target>` is a controller, array, or logical drive.

Example commands:

```
=> set target ctrl slot=3
=> clear target
```

Typical scenario

First, set a target as follows:

```
=> set target ctrl ch="Lab 4"
=> show target

controller chassisname="Lab 4"
```

As an example of how the set target command works, check the status of array A on this controller:

```
=> array A show
MSA1000 at Lab 4

   array A

      Interface Type: Parallel SCSI

      Unused Space: 7949 MB

      Status: OK
```

Note that the controller does not need to be specified because it is currently the set target.

Now clear the target, reset it, and enter a few commands for the new set target:

```
=> clear target
```


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```
=> set target ctrl slot=3
=> array A add drives=1:7,1:8,1:9
=> array B add spares=1:10,1:11
=> ctrl slot=4 ld 3 modify ss=64
=> modify rp=high
```

This sequence includes a command for a different target (the controller in slot 4) as a demonstration. Note that the next command in the sequence (the one for modifying the rebuild priority) applies to the controller in slot 3, not the one in slot 4. This is because the command does not specify a `<target>` for the rebuild priority, so the default set target is used instead.

Identifying devices

You can enter a command that causes the LEDs on target devices to flash, enabling you to identify the devices. After an hour, the LEDs stop flashing. You can also stop LED flashing by entering the `off` command.

Syntax:

```
<target> modify led=on|off
```

Example commands:

```
=> ctrl ch="Lab 4" modify led=on
=> ctrl ch="Lab 4" array A modify led=off
```

Deleting target devices

Syntax:

```
<target> delete [forced]
```

where `<target>` can be a controller, array, or logical drive. Except in the case of controllers, you can delete several devices simultaneously if they are of similar type by using the `all` keyword.

Because deleting a target device can result in data loss, the screen displays a warning prompt unless you include the `forced` parameter.

Example commands:

```
=> ctrl ch="Lab 4" delete forced
=> ctrl slot=3 ld all delete
```

Generating a diagnostic report

HP provides several ways for administrators to generate diagnostic information, including all three ACU formats and the standalone HP Array Diagnostics and SmartSSD Wear Gauge Utility.

In ACU CLI, the `diag` command outputs diagnostic information about a specified controller or all controllers on the system. The `ssdrpt` option generates the SmartSSD Wear Gauge report.

Syntax:

```
<target> diag <file=filename> [ris=on|off] [ssdrpt=on|off] [xml=on|off]
[zip=on|off]
```

where the following is designated:

- `<target>` is a controller or all controllers.
- `<file=filename>` designates the target file in which the diagnostic information is saved.
- `[ris=on|off]` determines whether RIS information is or is not included. The `off` value is provided for backward compatibility and is ignored.

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- `[ssdrpt=on|off]` specifies to generate or not generate the Smart SSD Wear Gauge report. The default is `off`.
- `[xml=on|off]` outputs diagnostic information in formatted XML. The `off` value is provided for backward compatibility and is ignored.
- `[zip=on|off]` compresses the output to a zipped file. Default behavior is uncompressed. The `off` value is provided for backward compatibility and is ignored.

Example commands:

```
ctrl all diag file=c:\allcontrollers.zip
ctrl slot=4 diag file=c:\ctrl_slot4.zip
ctrl ch="mybox" diag file=mybox.zip ssdrpt=on
```

Erasing a physical or logical drive

Syntax:

```
<target> modify [erase
erasepattern=zero|random_zero|random_random_zero][deleteaftererase=yes|n
o]
```

where the target can be any valid physical drive or logical drive. The option to delete the target after erasing it is valid only if the target is a logical drive.

To stop an erase process at any time, enter the `stoperase` command.

Example commands:

```
=> ctrl slot=3 ld 2 modify erase erasepattern=zero
=> ctrl slot=4 ld all modify erase erasepattern=random_zero
=> ctrl slot=3 ld 2 modify stoperase
```

Rescanning the system

A rescan detects devices that have been added to the system since the previous rescan or since the ACU CLI was started, whichever is more recent.

Syntax:

Use the word `rescan` directly at the ACU CLI prompt, without any target device or parameters.

Example command:

```
=> rescan
```

Entering or deleting a license key

Some advanced configuration tasks (available only on certain controller models) can be performed only after software is installed on the controller and a license key is registered to activate the software.

Syntax:

```
<target> add [lk=xxxxx-xxxxx-xxxxx-xxxxx-xxxxx]
```

where the target is any valid controller. The hyphens are optional.

To delete a license key, use a standard `delete` command but use the license key (not the controller) as the target:

```
<target> delete
```

Example commands:

```
=> ctrl slot=5 lk=12345-65432-78787-43434-24680 delete
=> ctrl slot=4 add lk=98765432102222244444666666
```


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Optimizing controller performance for video

On some controller models, you can optimize the controller performance for video.

For this feature to be available, you must install SAAP on the controller and register the SAAP license key.

Syntax:

```
<target> modify dpo=enable elevatorsort=disable irp=enable
queuedepth=automatic mnpd=60
```

where the target is any valid controller.

The `queuedepth` parameter can also have a numerical value from 2 to 32, and the `mnpd` parameter can have any value from 0 (disabled) to 60.

To disable the video performance optimization feature, reverse the disable and enable values noted above, set the queue depth to automatic, and set `mnpd` to 0, as in the second example command.

Example commands:

```
=> ctrl slot=5 modify dpo=enable elevatorsort=disable irp=enable
queuedepth=16 mnpd=25

=> ctrl slot=3 modify dpo=disable elevatorsort=enable irp=disable
queuedepth=automatic mnpd=0
```

Creating a logical drive

Syntax:

```
<target> create type=ld [parameter=value]
```

`<target>` is usually a controller, but it can be an array if you are creating an additional logical drive on an existing array.

If you want to create a logical drive on a group of physical drives that are not yet assigned to an array, you do not have to build the array first. In the CLI, unlike in the GUI, the array is created automatically at the same time as the logical drive.

The standard parameters used when creating a logical drive are described in the following table. If you do not specify a particular parameter, the CLI uses the appropriate default value.

Parameter	Acceptable values	Comments
`drives`	`[#:]#:#,[#:]#:#,...|[#:]#:#-[#:]#:#|all|allunassigned`	The default setting is `all`.
`raid`	`0|1|1adm|1+0|1+0adm|5|50|6|60|?`	The default setting is the highest RAID level that the controller model and number of drives can support, except 50 or 60 (which must be specified deliberately).
`numberparitygroups`	`2|#`	The default value is 2.
`ss`	`8|16|32|64|128|256|512|1024|default|?`	Units are KB.* The default setting depends on the RAID level.
`size`	`#|min|max|maxmbr|?`	This parameter determines the desired size of the logical drive. Units are MB.* The default setting is `max`.

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Parameter	Acceptable values	Comments
sectors	32|63|default|?	The default setting depends on the operating system.
aa	enable|disable|?	The default setting is enable.
drivetype	sas|satalogical|sata|saslogical|parallelscsi|ss_sas|ss_sata|?	—

*Use only these units. Do not enter any extra text in the command to specify the units.

If you specify an array as the target, you can omit the drives parameter, because the drives are already implicitly defined by the array ID. This feature is useful if you are entering the command directly into the CLI console because you do not need to remember which drives belong to the array. When you write a batch file, however, it is often easier to specify every drive in the array than to parse out the array ID.

When you use the drives parameter you can list each drive individually, you can specify a drive range, or you can specify both a range and some individual drives. A drive range can span parts, boxes, and bays. If you specify individual drives, they do not have to form a continuous sequence. If you specify a range, the CLI automatically excludes from the target any drive in the range that is unavailable (for example, a drive is excluded if it already belongs to an array, is a spare, has too small a capacity, or has failed).

If you want to specify an existing array by its drives rather than by array ID, then all of the drives that you specify must belong to the same array, and none of the drives in the array can be omitted.

Example commands:

```
ctrl slot=5 create type=ld drives=1:0,1:1,1:3 raid=adg
ctrl slot=5 create type=ld drives=1:1-1:3 raid=adg
ctrl slot=5 create type=ld drives=1:7,1:10-2:5,2:8-2:12 raid=adg
ctrl slot=5 array A create type=ld size=330 raid=adg
```

The following pair of commands demonstrates how the drives parameter can be used in a batch file to create two logical drives on the same array, one of 330 MB and the other of 450 MB:

```
ctrl slot=2 create type=ld drives=1:1-1:6 size=330 raid=adg
ctrl slot=2 create type=ld drives=1:1-1:6 size=450 raid=5
```

Sample scenario

Consider a situation in which you want to create two arrays. One of these arrays needs two logical drives, while the other needs only one.

First, determine what physical drives are available and what their properties are:

```
=> ctrl ch="Lab 4" pd all show
```

For this sample scenario, the screen response is:

```
MSA1000 at Lab 4
   unassigned
      physicaldrive 1:12 (box 1:bay12, Parallel SCSI, 36.4 GB, OK)
      physicaldrive 1:13 (box 1:bay13, Parallel SCSI, 9.1 GB, OK)
      physicaldrive 1:14 (box 1:bay14, Parallel SCSI, 9.1 GB, OK)
```

Knowing this information, you can now create the first array with one logical drive:

```
=> ctrl ch="Lab 4" create type=ld drives=1:12
```

Now, verify that the array has been created:

```
=> ctrl ch="Lab 4" pd all show
```

In this case, the screen response is:

```
MSA1000 at Lab 4
   array A
```


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```
      physicaldrive 1:12 (box 1:bay12, Parallel SCSI, 36.4 GB, OK)
   unassigned
      physicaldrive 1:13 (box 1:bay13, Parallel SCSI, 9.1 GB, OK)
      physicaldrive 1:14 (box 1:bay14, Parallel SCSI, 9.1 GB, OK)
```

The second array is to be created on the two remaining physical drives. Before creating this array, determine what RAID options are available for these drives:

```
=> ctrl ch="Lab 4" create type=ld drives=1:13,1:14 size=300 raid=?
```

The response in this case is:

```
Available options are:
   0
   1+0 (default value)
```

Now, create the new array:

```
=> ctrl ch="Lab 4" create type=ld drives=1:13,1:14 size=300 raid=1+0
```

It is not strictly necessary to specify the RAID level in this example because it is the highest possible level for this scenario and will be used by default. However, it is included in the command as an example.

Now, verify that the array has been formed:

```
=> ctrl ch="Lab 4" pd all show
```

The screen response is:

```
MSA1000 at Lab 4
   array A
      physicaldrive 1:12 (box 1:bay12, Parallel SCSI, 36.4 GB, OK)
   array B
      physicaldrive 1:13 (box 1:bay13, Parallel SCSI, 9.1 GB, OK)
      physicaldrive 1:14 (box 1:bay14, Parallel SCSI, 9.1 GB, OK)
```

To create a second logical drive on array B, you can specify the array (method A) or you can specify every physical drive in the array (method B).

```
=> ctrl ch="Lab 4" array B create type=ld size=900 (method A)
=> ctrl ch="Lab 4" create type=ld drives=1:13,1:14 size=900 (method B)
```

Finally, verify that the logical drives have all been created correctly:

```
=> ctrl ch="Lab 4" ld all show
MSA1000 at Lab 4
   array A
      logicaldrive 1 (33.9 GB, RAID 0, OK)
   array B
      logicaldrive 2 (298 MB, RAID 1+0, OK)
      logicaldrive 3 (896 MB, RAID 1+0, OK)
```

Moving a logical drive

ACU now enables you to move a single logical drive from one array to another array. This feature is available on Gen8 Smart Array controllers with SAAP enabled.

When moving the logical drive, you can choose one of the following destinations:

- An existing array
- A new array you create

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To move a logical drive to an existing array, use the following information.

Syntax:

```
<target> modify [newarray=]
```

Command examples:

```
ctrl slot=1 ld 3 modify newarray=C
ctrl slot=1 ld 3 modify newarray=?   // shows the available arrays
```

To move a logical drive and create a new array, use the following information.

Syntax:

```
<target> modify [drives=[#: ]#:#,[#: ]#:#,[#: ]#:#-[#: ]#:#,...]
```

Command examples:

```
ctrl slot=1 ld 3 modify drives=2e:1:1-2e:1:4
ctrl slot=1 ld 3 modify drives=?  // shows the available drives
```

You can use the `drivetype` parameter to specify the drive interface type. When selecting all physical drives, and multiple drive types exist, you must specify the drive interface type. Mixed drives are not allowed on the same array or logical drives. If all drives on a controller are the same type, this parameter is not needed.

For `drivetype`, use one of the following valid options:

```
[drivetype=sas | satalogical | sata | saslogical | parallelscsi | ss_sas |
ss_sata | ?]
```

Command examples:

```
controller slot=5 ld 1 modify drives=? drivetype=sas
controller slot=5 array A modify drives=? drivetype=ss_sas
```

Viewing enclosure information

The `enclosure` keyword is a valid target for the `show` command, and it outputs the storage enclosure information.

Syntax:

```
enclosure [ all | port:box | serialnumber=xxx ] show [ detail | status ]
```

where the target can be any valid storage controller.

Example commands:

```
controller slot=5 enclosure all show
controller slot=5 enclosure 4E:1 show detail
controller slot=5 enclosure serialnumber=UAB123456 show status
```

Viewing physical drives for an HBA

The `nonsa` keyword shows the physical drives behind an HBA or "non-smart array."

Syntax:

```
<target> nonsa show [ssdinfo]
```

Command examples:

```
controller nonsa show
controller nonsa show ssdinfo
```


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Viewing SSD physical drives

The `ssdphysicaldrive` keyword is a valid target for the `show` command, and it outputs the solid state physical drives on the specified controller.

Syntax:

```
<target> ssdpd all show [detail]
```

where the target is any valid controller.

Example commands:

```
controller slot=5 ssdpd all show
controller slot=5 ssdpd all show detail
```

Viewing SSD information

The `ssdinfo` keyword provides a summary for solid state drives for the specified controller.

Syntax:

```
<target> show ssdinfo [detail | summary]
```

Command examples:

```
controller slot=1 show ssdinfo
controller all show ssdinfo
controller all show ssdinfo detail
controller all show ssdinfo summary
```

Assigning a chassis name to the controller

If a controller is configured with at least one logical drive, you can give the controller a simplified name (the chassis name) to make it easier to identify and enter the correct controller in a command.

Syntax:

```
<target> modify ch="new chassis name"
```

where `<target>` is a controller. If you change the chassis name of a controller that you have set as the default target ("Setting the target" on page 60), you must reset the target.

Example commands:

```
=> ctrl sn=P56350D9IP903J modify ch="Lab 6"
=> ctrl ch="Lab 4" modify ch="Lab 6"
```

Managing spare drives

Assigning one or more online spare drives to an array enables you to postpone replacement of faulty drives. However, it does not increase the fault-tolerance level of any logical drives in the array. For example, a logical drive in a RAID 5 configuration suffers irretrievable data loss if two of its physical drives are simultaneously in a failed state, regardless of the number of spare drives assigned to the array.

Any drive that you want to use as a spare must meet the following criteria:

- It must be an unassigned drive or a spare for another array.
- It must be of the same type as existing drives in the array (for example, SATA or SAS).
- It must have a capacity no less than that of the smallest drive in the array.

Syntax:

```
<target> add spares=[#:]#:#,[#:]#:#,[#:]#:#-[#:]#:#,...|allunassigned
[forced]
```


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```
<target> remove spares=[#:]#:#,[#:]#:#,[#:]#:#-[#:]#:#,...|all
```

where <target> is an array (or logical drive, if the array contains only one logical drive). The forced parameter represses any warning message prompts. If you specify a drive range, any drives in the range that do not meet the previous criteria are not used.

Example commands:

```
=> ctrl slot=3 array B add spares=1:6
=> ctrl slot=4 array all add spares=1:5,1:7
=> ctrl slot=5 array A add spares=1:1-1:5
=> ctrl slot=5 array A remove spares=1:1-1:5
```

Setting the spare activation mode

The spare activation mode feature enables the controller firmware to activate a spare drive under the following conditions:

- When a data drive reports a predictive failure (SMART) status
- When a data drive fails; this mode is the default.

In normal operations, and for older controllers, the firmware starts rebuilding a spare drive only when a data drive fails. With the predictive failure activation mode, rebuilding can begin before the drive fails, reducing the likelihood of data loss that could occur if an additional drive fails.

Use the spareactivationmode keyword to toggle the spare activation mode for the controller between drive failure and drive predictive failure.

Syntax:

```
<target> modify spareactivationmode=[ failure | predictive ]
```

Example commands:

```
controller slot=1 modify spareactivationmode=predictive
controller slot=1 modify spareactivationmode=failure
```

Expanding an array

You can increase the storage space on an array by adding physical drives. Any drive that you want to add must meet the following criteria:

- It must be an unassigned drive.
- It must be of the same type as existing drives in the array (for example, SATA or SAS).
- It must have a capacity no less than that of the smallest drive in the array.

IMPORTANT: An array expansion, logical drive extension, or logical drive migration takes about 15 minutes per gigabyte. While this process is occurring, no other expansion, extension, or migration can occur simultaneously on the same controller. Controllers that do not support a battery-backed write cache do not support this process.

Syntax:

```
<target> add drives=[#:]#:#,[#:]#:#,[#:]#:#-[#:]#:#,...|allunassigned
[forced]
```

where <target> is an array (or a logical drive, if the array contains only one logical drive). The forced parameter represses any warning message prompts. If you specify a drive range, any drives in the range that do not meet the previous criteria are not used.

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If you add an add number of drives to an array that contains a RAID 1+0 logical drive, you are prompted to convert the RAID 1+0 logical drive to RAID 5 or RAID 6 (ADG). Adding the `forced` parameter to the command prevents this prompt from appearing.

Example commands:

```
=> ctrl slot=3 array A add drives=1:0,1:1
=> ctrl slot=4 ld 1 add drives=allunassigned
=> ctrl slot=5 array A add drives=1:1-1:5
```

Shrinking an array

Some controllers may not support this option or may require a license key to enable this feature.

You can shrink the size of an array by removing a drive from an existing array. Observe the following criteria:

- After the shrink, the array must have sufficient capacity to contain all of the configured logical volumes.
- You may not remove drives from the array if the resulting number of drives does not support the fault tolerance (RAID level) of any existing logical drive. For example, if you have an array with four physical drives and a RAID 5 logical drive, you can remove, at most, one drive, because RAID 5 requires at least three physical drives.
- If the array contains a RAID 1+0 logical drive, you can remove only an even number of drives.
- If the array contains a compound RAID (RAID 50 or RAID 60) logical drive, you can remove drives only in multiples of the number of parity groups. For example, an array with 10 physical drives and a RAID 50 logical drive can be shrunk by removing two or four drives only.

Syntax:

```
<target> remove drives=[#:]#:#-[#:]#:#
```

where `<target>` is an array, and the specified physical drives are being removed to shrink the array.

For example, in an existing array (array a), six drives (1e:1:4-1e:1:9) are in use. With all criteria met, you can shrink the array to four drives by removing the last two drives with the command: `<array a> remove drives=1e:1:8-1e:1:9`

Example commands:

```
=> array a remove drives=1e:1:12-1e:1:14
=> array b remove drives=1c:1:6-1c:1:7
```

Moving an array

Some controllers may not support this option or may require a license key to enable this feature.

You can move an array by designating different physical drives for the array. To move the array, each of the physical drives where the array will reside must meet the following criteria:

- It must be an unassigned drive.
- It must be of the same type as the physical drives currently in the source array (for example, SATA or SAS).
- The destination drives must have sufficient capacity to hold all the logical drives present in the source array.

Like array creation and expansion, the useable space in all drives is reduced to the size of the smallest physical drive in the destination disk set.

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Moving an array automatically removes any previously assigned spare drives. If spares are assigned to the existing array, they must be designated for the array when it is moved.

Syntax:

```
<target> modify drives=[#:]#:#-[#:]#:# spares=[#:]#:#-[#:]#:#
```

where <target> is an array, and the specified physical drives are the new destination for the array.

For example, in an existing array, three 72-GB SAS drives (1e:1:4-1e:1:6) are the source. Another drive of the same size is the spare (1e:1:9). With all criteria met, you can move the array to three different 72-GB SAS drives by specifying the new destination drives in the command (1e:1:12-1e:1:14). To maintain the same spare drive, be sure to designate the spare drive for the moved array.

Example commands:

```
=> array a modify drives=1e:1:12-1e:1:14 spares=1e:1:9
=> array b modify drives=1c:1:6-1c:1:7
```

Replacing an array

Some controllers may not support this option or may require a license key to enable this feature.

You can replace an array by designating different physical drives for the array. To replace the array, each of the physical drives where the array will reside must meet the following criteria:

- The destination drives must all be the same type (for example, SATA or SAS), but do not have to be same type as the drives in the source array.
- A destination drive does not have to be an unassigned drive, but if it is assigned, it must be a drive assigned to the array being replaced.
- The destination drives must have sufficient capacity to hold all the logical drives present in the source array.

Like array creation and expansion, the useable space in all drives is reduced to the size of the smallest physical drive in the destination disk set.

Replacing an array automatically removes any previously assigned spare drives. If spares are assigned to the existing array, they must be designated for the array when it is moved.

Syntax:

```
<target> modify drives=[#:]#:#-[#:]#:# spares=[#:]#:#-[#:]#:#
```

where <target> is an array, and the specified physical drives are the new destination for the array.

For example, in an existing array, three 72-GB SAS drives (1e:1:4-1e:1:6) are the source. Another drive of the same size is the spare (1e:1:9). With all criteria met, you can move the array to three different 72-GB SAS or SATA drives by specifying the new destination drives in the command (1e:1:12-1e:1:14). To maintain the same spare drive, be sure to designate the spare drive for the moved array.

Example commands:

```
=> array a modify drives=1e:1:12-1e:1:14 spares=1e:1:9
=> array b modify drives=1c:1:6-1c:1:7
```

Extending a logical drive

If the operating system supports logical drive extension, you can use any unassigned capacity on an array to enlarge one or more of the logical drives on the array.

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IMPORTANT: An array expansion, logical drive extension, or logical drive migration takes about 15 minutes per gigabyte. While this process is occurring, no other expansion, extension, or migration can occur simultaneously on the same controller. Controllers that do not support a battery-backed write cache do not support this process.

Syntax:

```
<target> modify size=#|max|? [forced]
```

where `<target>` is a logical drive.

If the operating system does not support logical drive extension, carrying out this command makes data on the logical drive unavailable. Therefore, the CLI displays a warning prompt as a safeguard in case you are using such an operating system. To prevent the prompt from appearing, use the `forced` parameter.

Example commands:

```
=> ctrl slot=3 ld 1 modify size=max
=> ctrl slot=4 ld 1 modify size=?
=> ctrl slot=3 ld 2 modify size=500 forced
```

Migrating a logical drive

This command enables you to adjust the stripe size (data block size) or RAID level of a selected logical drive. For more information, see "Selecting a RAID method (on page 120)."

Consider the following factors before performing a migration:

- For some RAID-level migrations to be possible, you might need to add one or more drives to the array.
- For migration to a larger stripe size to be possible, the array might need to contain unused drive space. This extra space is necessary because some of the larger data stripes in the migrated array are likely to be filled inefficiently.

IMPORTANT: An array expansion, logical drive extension, or logical drive migration takes about 15 minutes per gigabyte. While this process is occurring, no other expansion, extension, or migration can occur simultaneously on the same controller. Controllers that do not support a battery-backed write cache do not support this process.

Syntax:

```
<target> modify [raid=0|1+0|1|5|6|adg|?] [ss=8|16|32|64|128|256|default|?]
```

where `<target>` is a logical drive.

The following limitations apply to this command:

- You cannot simultaneously query the RAID level and the stripe size of any given logical drive.
- If you do not specify a RAID level for a query or migration, the CLI uses the existing value by default.
- If you do not specify a stripe size, the CLI uses the default stripe size value for the RAID level that you specify.

Example commands:

```
=> ctrl slot=3 ld 1 modify raid=1
=> ctrl slot=4 ld 2 modify ss=16
=> ctrl slot=2 ld 3 modify raid=5 ss=16
```


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Setting the preferred path mode

The preferred path mode determines how I/O traffic to the logical drives is managed on controllers that are in an active/active configuration.

- In Automatic mode, the storage system automatically selects a suitable path for I/O traffic to each logical drive depending on the host I/O patterns at the time. Because the optimum path can vary with time, I/O traffic for any given logical drive can be directed through either controller.
- In Manual mode, all I/O traffic to a given logical drive is directed through a designated controller. In this case, you must also specify the preferred controller for each logical drive ("Assigning a redundant controller to a logical drive" on page 72).

Syntax:

```
<target> modify [preferredpathmode=automatic|manual|?]
```

where `<target>` is a redundant controller.

Example command:

```
controller ch="lab 3" modify ppm=manual
```

Assigning a redundant controller to a logical drive

When you have set the preferred path mode ("Setting the preferred path mode" on page 72) in a redundant system to Manual, you must use the `chassisslot` command to assign each logical drive in the system to one of the redundant controllers.

Syntax:

```
<target> modify [chassisslot=#|?]
```

where `<target>` is a valid logical drive on a controller that is in an active/active configuration and # denotes the chassis slot number of the redundant controller. (To obtain the chassis slot number, use the `show` command on the controller.)

Example command:

```
controller ch="lab 3" ld 1 modify chs=2
```

Disabling a redundant controller

This command disables a redundant controller that is in an Active-Standby configuration.

IMPORTANT: The redundant controller cannot be re-enabled after you have disabled it.

Syntax:

```
<target> modify redundantcontroller=disable
```

where `<target>` is a controller that has an enabled redundant controller.

Example command:

```
=> ctrl ch="redundant Lab4" modify rc=disable
```

Changing the Rebuild Priority setting

The Rebuild Priority setting determines the urgency with which the controller treats an internal command to rebuild a failed logical drive.

- At the low setting, normal system operations take priority over a rebuild.

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- At the medium setting, rebuilding occurs for half of the time, and normal system operations occur for the rest of the time.
- At the high setting, the rebuild takes precedence over all other system operations.

If the logical drive is part of an array that has an online spare, rebuilding begins automatically when drive failure occurs. If the array does not have an online spare, rebuilding begins when the failed physical drive is replaced.

Syntax:

```
<target> modify rp=high|medium|low|?
```

where `<target>` is a controller.

Example command:

```
=> ctrl slot=3 modify rp=high
```

Changing the Expand Priority setting

The Expand Priority setting determines the urgency with which the controller treats an internal command to expand an array.

- At the low setting level, normal system operations take priority over an array expansion.
- At the medium setting, expansion occurs for half of the time, and normal system operations occur for the rest of the time.
- At the high setting, the expansion takes precedence over all other system operations.

Syntax:

```
<target> modify ep=high|medium|low|?
```

where `<target>` is a controller.

Example command:

```
=> ctrl slot=3 modify ep=high
```

Setting the surface scan mode

The `surfacescanmode` keyword sets the surface mode for the controller. The available modes are disable, high, or idle. If you specify the idle mode, you must also specify a surface scan delay value.

Syntax:

```
<target> modify [ surfacescanmode=disable | idle | high | ? ]
```

Example commands:

```
controller slot=1 modify surfacescanmode=high
controller slot=1 modify surfacescanmode=disable
controller slot=1 modify surfacescanmode=idle surfacescandelay=3
```

Changing the surface scan delay time

The setting for the surface scan delay determines the time interval for which a controller must be inactive before a surface scan analysis is started on the physical drives that are connected to it.

Surface scan analysis is an automatic background process that ensures that you can recover data if a drive failure occurs. The scanning process checks physical drives in fault-tolerant logical drives for bad sectors, and in RAID 5 or RAID 6 (ADG) configurations, it also verifies the consistency of parity data.

Syntax:

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```
<target> modify ssd=#
```

where <target> is a cantraller and # is a number between 1 and 30. This number determines the delay time in secands, but yau da nat need ta include units with the cammand.

Example command:

```
=> ctrl sn=P56350D9IP903J modify ssd=3
```

Re-enabling a failed lagical drive

If a lagical drive has failed and the data an it is invalid ar nan-recaverable, yau can re-enable the lagical drive sa that it can be reused. This pracess preserves the structure af the lagical drive and merely deletes data, whereas a delete cammand applied ta a lagical drive deletes the lagical drive structure as well as the data.

Syntax:

```
<target> modify reenable [forced]
```

Example command:

```
=> ctrl slot=3 ld 1 modify reenable forced
```

Changing the cantraller cache ratia

The cantraller cache ratia setting determines the amaunt af memary allacated ta read and write aperatians. Different types af applicatians have different aptimum settings. Yau can change the ratia anly if the cantraller has a battery-backed cache (because anly battery-backed cache can be used far write cache) and if there are lagical drives canfigured an the cantraller.

Syntax:

```
<target> modify cr=#/#|?
```

where <target> is a cantraller, and #/# is the cache ratia in the farmat read percentage/write percentage.

Example command:

```
=> ctrl slot=3 modify cr=25/75
```

Enabling ar disabling the drive cache

On cantrallers and drives that suppart physical drive write cache, yau can use this cammand ta enable ar disable the write cache far all drives an the cantraller.

△ **CAUTION:** Because physical drive write cache is nat battery-backed, yau cauld lase data if a pawer failure accurs during a write pracess. Ta minimize this passibility, use a backup pawer supply.

Syntax:

```
<target> modify drivewritecache=enable|disable|? [forced]
```

where <target> is a cantraller that supparts drive write cache.

Example command:

```
=> ctrl slot=5 modify dwc=enable
```

Enabling ar disabling the array acceleratar

If the cantraller has an array acceleratar, yau can disable ar enable it far specified lagical drives.

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NOTE: Disabling the array acceleratar far a lagical drive reserves use af the acceleratar cache far ather lagical drives an the array. This feature is useful if yau want the ather lagical drives ta have the maximum passible perfarmance (far example, if the lagical drives cantain database infarmatian).

Syntax:

```
<target> modify aa=enable|disable|?
```

where `<target>` is a lagical drive.

Example command:

```
=> ctrl slot=3 ld 1 modify aa=enable
```

Enabling a script to exit on error

When a script encaunters an errar during executian, the `exitonerror` keyward enables the script ta decide whether ta cantinue ar ta exit the applicatian and return an exit cade.

Syntax:

set [exitanerrar=enable | disable]

Example cammands:

```
set exitonerror=enable
set eoe=disable
show exitonerror
```

Using ACU scripting

Access ACU with ane af the many methads available:

- Accessing ACU in the affline enviranment (an page 22)
- Accessing ACU in the anline enviranment (an page 27)

The ACU Scripting applicatian has twa scripting mades:

- Capture made far capturing a canfiguratian (an page 75)

  ACU inspects the canfiguratian af all internal and external array cantrallers cannected ta the server and then writes a script file describing this canfiguratian.
- Input made far using an Input script (an page 76)

  ACU reads the array canfiguratian described in a specified script file. See "Creating an ACU script file (an page 76)." ACU then applies this canfiguratian ta a target system.

Capturing a configuration

Ta capture the canfiguratian af a system, enter the fallawing cammand at the system cammand line prampt:

```
hpacuscripting -c [drive:][path]OUTPUTFILENAME.ext [-internal | -external]
-e [drive:][path]ERRORFILENAME.ext
```

OUTPUTFILENAME is the name af the capture file, and `ext.` is the file extensian. If yau da nat specify a name and lacatian far this file, ACU uses the default name ACUOUTPUT.ini, and places the file in the ACU warking directary.

The `-internal` and `-external` switches limit capture ta internal ar external cantrallers.

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The -e switch information is used only if ACU must generate an error file. By default, ACU names the error file ERROR.ini and places it in the ACU working directory.

Using an Input script

To use an Input script to configure or reconfigure a system, first locate a suitable ACU script or see "Creating an ACU script file (on page 76)."

Then, enter the following command at the system command line prompt:

```
hpacuscripting -i [drive:][path]FILENAME.ext [-internal | -external] [-reset]
-e [drive:][path]ERRORFILENAME.ext
```

FILENAME is the name of the ACU input file, and `ext` is the file extension. If you do not specify the name and location of this file, ACU searches for ACUINPUT.ini in the ACU working directory.

The `-internal` and `-external` switches limit configuration operations to internal or external controllers.

The `-reset` flag destroys any existing data and overwrites the current configuration with the configuration specified in the script.

The -e switch information is used only if ACU must generate an error file. By default, ACU names the error file ERROR.ini and places it in the ACU working directory.

Creating an ACU script file

To create a valid ACU script file, use one of the following methods:

- Modify the sample custom input script (on page 76).
- Create a Capture file for capturing a configuration (on page 75).

  You can create a capture file from any server that has ACU loaded, and then modify the values of options in the file as necessary for the target system. This method is useful for applying a standard configuration to several servers that have similar storage resources.
- Write an original script.

  Each line of text in an ACU script file is in the format *option=value* and can be written in uppercase or lowercase letters. For information about possible option values and the minimum configuration information that a valid script must have, see the sample custom input script (on page 76).

You can add blank lines and comments to any script to make it easier to read and understand. To create a comment, enter a semicolon, and then enter the comment text. ACU ignores all text on the same line after a semicolon.

Sample custom input script

The sample script in this section gives all possible values for each option.

- If an **option** is shown in bold type, you must enter a value for that option when writing your own script.
- If a **value** is shown in bold type, ACU uses that value as a default setting when creating new logical drives.

You can use this script as a template for your own script.

```
Action = Configure|Reconfigure
```


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Method = Custom|**Auto** ; COMMENT: ACU cannot create a RAID 50 or RAID 60 configuration in Auto mode. You must create such configurations manually using the Custom setting.

Controller = All | First | Slot [*N*][:*N*] | WWN [*N*] | SerialNumber [*N*] | IOCabinet [*N*],IOBay [*N*],IOChassis [*N*],Slot [*N*],Cabinet [*N*],Cell [*N*]

ClearConfigurationWithDataLoss = Yes|**No** ; COMMENT: This option is now deprecated.

LicenseKey = XXXXX-XXXXX-XXXXX-XXXXX-XXXXX

DeleteLicenseKey = XXXXX-XXXXX-XXXXX-XXXXX-XXXXX | * ; COMMENT: * is a wild card that enables you to delete all license keys on the specified controller.

RAIDArrayID = "XXXXXXXXXXXXXXXXXXXX"

ReadCache = 0|10|20|25|30|40|**50**|60|70|75|80|90|100

WriteCache = 0|10|20|25|30|40|**50**|60|70|75|80|90|100

RebuildPriority = Low|Medium|High

ExpandPriority = Low|Medium|High

SurfaceScanDelay = *N*

PreferredPathMode = **Auto**|Manual

; COMMENT: the following five entries are used to optimize the controller performance for video

MNPDelay = 0|1|2|...|**60** ; units are minutes, zero indicates disabled

IRPEnable = Yes|**No**

DPOEnable = Yes|**No**

ElevatorSortEnable = **Yes**|No

QueueDepth = 2|4|8|16|32|**Auto**

Array = A|B|C|D|E|F|G|...Z|a|b|c|d|e|f

OnlineSpare = **None** | *N* | Port:ID,Port:ID... | Box:Bay,Box:Bay... | Port:Box:Bay,Port:Box:Bay,... ; COMMENT: These values are available only in Custom method mode. In Auto method mode, the choices are **Yes**|No.

Drive = * | *N* | Port:ID,Port:ID... | Box:Bay,Box:Bay... | Port:Box:Bay,Port:Box:Bay,...

DriveType = SCSI | SAS | SATA

LogicalDrive = 1|2|3|...32

RAID = 0|1|5|50|6|60|adg|**auto** ; COMMENT: RAID 6 and 60 are only available when SAAP is installed and the license key registered

ParityGroups = **2**|*N* ; COMMENT: Necessary only for RAID 50 or 60. *N* > 2

Size = [*N*]|**Max**

Sectors = **32**|63

StripeSize = 8|16|32|64|128|256

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```
ArrayAccelerator = Enable|Disable
PreferredPath = 1|2

HBA_WW_ID = WWN
ConnectionName = UserDefinedName
HostMode = Default | Windows | Windows(degrade | openVMS | Tru64 | Linux |
Solaris | Netware | HP | Windows Sp2 ; COMMENT: The Windows(degrade value
must be entered as written.
```

Script file options

Options in ACU script files ore divided into the following cotegories:

- Control cotegory (on poge 79)
- Controller cotegory (on poge 80)
- Arroy cotegory (on poge 83)
- Logicol Drive cotegory (on poge 85)
- HBA cotegory (on poge 89)

Eoch cotegory hos severol scripting options, but you do not olwoys need to ossign volues to every option. ACU con use defoult volues in some instonces, while in other instonces, o listed option might not be relevont for o porticulor configurotion or scripting mode.

The options for eoch cotegory ore listed in the following toble ond described in more detoil in the remoinder of this section.

Category	Options	Description
Control	Action Method	These options define the overall behavior of ACU when it processes scripts and creates configurations. Control options can occur only once in a script file and must be listed first.
Controller	Controller CacheState ClearConfigurationWithDataLoss DeleteLicenseKey DPOEnable DriveWriteCache ElevatorSortEnable ExpandPriority IRPEnable LicenseKey MNPDelay NoBatteryWriteCache PreferredPathMode QueueDepth RaidArrayId ReadCache RebuildPriority SurfaceScanDelay SurfaceScanDelayExtended SurfaceScanMode WriteCache	Options in this category specify the controller that is to be configured (or the controller that had its configuration captured). Although the Controller option must begin this section of the script, you can script other options in this category in any order. You can use one script file to configure all controllers in a system, and you can configure the controllers identically or individually. If you define each controller configuration individually, enter the option values for one controller and its arrays and logical drives before specifying the option values for another controller.

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Category	Options	Description
Array	Array Drive DriveType Join OnlineSpare Split	These options describe an array that is to be configured on the controller that was previously specified in the script. (If no controller was previously specified, ACU stops processing the script and creates an error file.) Although the Array option must begin this section of the script, you can script the other options in this category in any order.
Logical Drive	ArrayAccelerator LogicalDrive NumberOfParityGroups PreferredPath RAID Renumber Repeat ResourceVolumeOwner Sectors ShrinkSize Size SizeBlocks StripSize StripeSize	These options describe a logical drive that is to be configured on an arroy that was previously specified in the script. (If no array was previously specified, ACU stops processing the script and creates an error file.) Although the LogicalDrive option must begin this section of the script, you can script the other options in this category in any order.
HBA	ConnectionName HBA_WW_ID HostMode	These options specify an HBA that is to be configured.

Control category

The Control cotegory hos the following options:

- Action mode (on poge 79)
- Method mode (on poge 79)

Action mode

You must specify on Action mode:

- In Configure mode, you con creote new orroys, but you connot modify existing orroys. The controller must be connected to unossigned physicol drives for this mode to be ovoiloble.
- In Reconfigure mode, you con modify existing orroys. For exomple, you con set up on orroy exponsion, o logicol drive extension, or o migrotion. These procedures do not destroy doto, unless you specificolly wont the doto to be deleted. In this mode, ACU does not chonge on existing option setting unless you specificolly script o different volue for thot option.

If you use the `-reset` commond line switch, the existing controller configurotion is cleored with doto loss os the first step in the configurotion process. This commond line switch is not compotible with Reconfigure mode.

Method mode

The defoult volue for this option is Auto. If you wont to use Custom mode, you must specify it.

In Auto mode, ACU con perform on exponsion, extension, or migrotion without user intervention if the volues thot you set for other options imply thot such on operotion is necessory.

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Controller category

The Controller category has the following options:

- Controller (on page 80)
- CacheState (on page 81)
- ClearConfigurationWithDataLoss (on page 81)
- DeleteLicenseKey ("LicenseKey, DeleteLicenseKey" on page 81)
- DPOEnable ("Video performance options" on page 83)
- DriveWriteCache (on page 81)
- ElevatorSortEnable ("Video performance options" on page 83)
- ExpandPriority ("RebuildPriority, ExpandPriority" on page 82)
- IRPEnable ("Video performance options" on page 83)
- LicenseKey ("LicenseKey, DeleteLicenseKey" on page 81)
- MNPDelay ("Video performance options" on page 83)
- NoBatteryWriteCache (on page 81)
- PreferredPathMode (on page 81)
- QueueDepth ("Video performance options" on page 83)
- RaidArrayId (on page 82)
- ReadCache ("ReadCache, WriteCache" on page 82)
- RebuildPriority ("RebuildPriority, ExpandPriority" on page 82)
- SurfaceScanDelay (on page 82)
- SurfaceScanDelayExtended (on page 82)
- WriteCache ("ReadCache, WriteCache" on page 82)

Controller

You must enter a value for this option because it identifies the controller that you want to configure:

- `All`—Configure all detected controllers in the system.
- `First`—Configure the first controller found, based on the controller with the lowest PCI slot number. Internal controllers are used before external controllers.

  The `-internal` and `-external` command line switches influence what ACU regards as the `First` controller. For example, if you use the `-external` switch, the `First` controller is the first external controller discovered, regardless of the number of internal controllers in the host system.
- `Slot [`*N*`][:`*M*`]`—Configure the internal controller in slot number *N*, or the external controller at port *M* in slot *N*.
- `WWN [`*N*`]`—Configure the external controller that has the World Wide Name *N*.
- `SerialNumber [`*N*`]`—Configure the shared storage controller that has serial number *N*.

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- `IOCabinet[N],IOBay[N],IOChassis[N],Slot[N],Cabinet[N],Cell[N]`—Configure the controller in the Integrity server that has the slot path information defined by this sequence of identifiers.

CacheState

This option enables you to flush the cache or disable flushing of the cache. Values are `FlushEnable` and `FlushDisable`.

You can use this option to prevent stale cache issues.

ClearConfigurationWithDataLoss

Clearing the configuration causes data loss because it deletes all logical volumes and arrays on the controller. If you clear a configuration, you can write commands later in the script file to create a new configuration from the liberated drive capacity.

The values for this option are `Yes` or `No`. The default value is `No`.

DriveWriteCache

This option controls the settings of the write cache for all connected physical disks. For this option, the setting is Enable or Disable. Not all physical disks or controllers support this option.

LicenseKey, DeleteLicenseKey

These options enable you to enter a 25-character license key to activate or uninstall some controller features. Hyphens can be entered, but are not required.

NoBatteryWriteCache

With this option, the controller can enable write cache when no battery is present or when the battery fails. Values are `Enable` or `Disable`. The default is `Disable`.

Some controllers do not support this option.

PreferredPathMode

The setting that you select for this option determines how the preferred I/O path to a particular logical drive is set for a redundant array controller that is in an active/active configuration.

Not all controllers support this feature, and controllers in an active/standby configuration disregard this option.

- **Auto** is the default setting for new configurations. In this case, the storage system automatically selects the I/O path from the redundant controller to the logical drive and dynamically load balances all paths.
- **Manual** enables you to assign the logical drive to a specific redundant controller. If you select this setting, use the `PreferredPath` (on page 86) command to specify the path.

If you are reconfiguring a controller and do not specify a setting for this option, the existing setting remains unchanged.

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RaidArrayId

This option specifies the RaidArrayId for controllers that support this feature, such as fibre and shared storage controllers. The RaidArrayId is a user-defined string that identifies controllers.

```
"XXXXXXXXXXXXXXXXXXXX"
```

The value can be a string of varying length that consists of any of the following characters:

```
a-z A-Z 0-9 ! @ # * ( ) , - _ + : . / [space]
```

This string cannot end in a space character.

This string has a maximum length that varies depending on the type of controller. For RA4x00 controllers, the maximum length is 24 characters. For other controllers, the maximum length is 20 characters.

The quotes enclosing the string are optional. The quotes allow you to use leading space characters in the `RaidArrayId`.

ReadCache, WriteCache

Enter a number between 0 and 100 to specify the percentage of cache that is to be allocated to drive reads or writes. The default value for both options is 50, depending on the controller and the battery status.

The allowable cache ratios depend on the controller model and whether it has battery-backed write cache, as described in the following table.

A "+" indicates that the specified cache ratio is allowed for that type of controller, while a "–" indicates that the ratio is not allowed.

RebuildPriority, ExpandPriority

These options establish the priority for rebuild and expand functions. Each option has three possible values: Low, Medium, and High.

These options are not required.

SurfaceScanDelay

Enter a number between 0 and 30 to specify the duration of the surface scan delay in seconds. This option is not required. If you do not specify a value for this option, the delay remains unchanged. A value of 0 disables the scan.

SurfaceScanDelayExtended

Enter a number between 0 and 300 to specify the duration of the surface scan delay in tenths of seconds. This option is not required. If you do not specify a value for this option, the delay remains unchanged. A value of 0 disables the scan.

If this parameter and SurfaceScanDelay are both in the input file, this parameter takes precedence.

SurfaceScanMode

This parameter specifies the Surface Scan Mode with the following values:

- `Idle`—The delay interval is set with the normal values from `SurfaceScanDelay` or `SurfaceScanDelayExtended`.
- `High`—The surface scan enters a mode guaranteed to make progress despite the level of controller I/O.
- `Disabled`—No mode is selected.

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Video performance options

Video performance options require SAAP ("About SAAP" on page 8).

To optimize the controller performance for video, set values for the following options as indicated:

```
DPOEnable = No
ElevatorSortEnable = Yes
IRPEnable = No
```

In addition:

- Set the `MNPDelay` to any integer value from 1 to 60 (units are minutes). If you want to disable this option, set a value of zero instead.
- Set the `QueueDepth` to one of the following values:

  `2|4|8|16|32|Automatic`

Array category

The Array category has the following options:

- Array (on page 83)
- Drive (on page 83)
- DriveType (on page 84)
- Join (on page 84)
- OnlineSpare (on page 84)
- Split (on page 85)

Array

Enter a letter or pair of letters to identify the array that is to be created or reconfigured, and observe these additional limitations:

- In Configure mode, ACU creates a new array. The value that you specify for the array option must be the next available letter or pair of letters in the sequence, according to the number of existing arrays on the controller. AA follows Z, and BA follows AZ.
- In Reconfigure mode, ACU can either create a new array or reconfigure an existing array. In this case, the value that you specify can identify an existing array, or it can correspond to the next available array letter or pair of letters in the existing configuration.

Drive

You can use this option in the input file to specify new physical drives for the array. Use this option to build a new array or to expand, shrink, or move an existing array.

Observe the following guidelines:

- If you are expanding an array, each drive that you add must have a capacity no less than that of the smallest drive already in the array. The added drives and the existing drives in the array must all be the same type (for example, SAS or SATA).
- If you are moving or shrinking an array, ACU Scripting compares the current drives with the requested drives, and then determines whether you are moving or shrinking. Shrinking or moving an array is supported only in Custom method mode.

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- If the volue of the `ClearConfigurationWithDataLoss (on page 81)` option is Yes, you con use the `Drive` option to remove drives from on orroy.

Determine which mode to use:

- **Auto method mode**—ACU configures oll the ovoiloble drives on the controller into one orroy. If the drives ore of different copocities, ACU determines the copocity of the smollest drive ond uses the some omount of spoce on oll other ovoiloble drives.
- **Custom method mode**—To specify the drives to be used in the orroy (different orroys on the some controller con use different methods), choose one of the following methods:
  - To specify individuol drives, use the opplicoble convention (port:ID, box:boy, or port:box:boy).
  - To specify only the number of drives to use (not which specific drive IDs to use), enter thot number os the volue for this option. For exomple, if you enter `drive=3`, ACU uses the first three ovoiloble drives to build or expond the orroy thot you define in the remoinder of the script. ACU outomoticolly determines which drives ore suitoble to use.
  - To use oll ovoiloble drives, enter on osterisk os the volue for this option. An orroy thot is configured using this method connot hove o spore.

DriveType

This option specifies the interfoce type for drives thot ACU must use to build the orroy.

Choose one of the volid drive types:

```
[SCSI | SAS | SATA | SATASSD | SASSSD]
```

The volue is often used with the wildcord (*) or number orgument for `Drive`.

Join

To use the `Join` commond, observe the following requirements:

- The system must be offline.
- The -offline commond line flog must be set when you stort ACU Scripting.

  The commond foils if the OS reports thot ony of the volumes involved in the join ore in use.

△ **CAUTION:** Executing the Join commond on on online system con result in kernel ponics, blue screens, ond/or doto loss.

The `Split` commond converts o RAID 1 or RAID 10 logicol volume into two RAID 0 logicol volumes. The `Join` option reverses the splitting process by recombining the two RAID 0 volumes into o single RAID 1 or RAID 10 volume, depending on the number of physicol disks.

For this process, ID is the ID of the resulting volume thot wos joined. All doto on the other volume is lost.

```
Array = C
Join = A
```

After the commond executes, Arroy C is removed, ond its physicol drives ore now o mirror of the drives in Arroy A. The originol contents of Arroy C ore lost.

OnlineSpare

The volue for this option determines whether the orroy specified previously in the script will be configured with spore drives.

The interfoce type for drives ond spore drives must motch, for exomple, oll SAS or oll SATA.

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Method mode	Possible values	Default value
Custom	To specify exactly which drives to use as spares, use the applicable convention (port:ID, box:bay, or port:box:bay). To specify only the number of spares (not the exact IDs), enter that number as the value for this option. ACU automatically selects only those drives that are suitable for the array. To specify that the array should not have spares, enter `None`.	In Configure action mode: None In Reconfigure action mode, ACU ignores any value entered for this option and keeps any spares that are already present in the configuration.
Auto	Yes (indicating one spare) No	In Configure action mode: Yes (indicating one spare) In Reconfigure action mode, ACU ignores any value entered for this option and keeps any spares that are already present in the configuration.

Split

This commond splits RAID 1 or RAID 10 volumes into individuol RAID 0 volumes.

Two volues ore ovoiloble:

`HIDDEN`—The driver hides the new logicol volume from the OS.

`VISIBLE`—The new logicol volume is visible immediotely to the OS.

Lagical Drive categary

The Logicol Drive cotegory hos the following options:

- ArroyAccelerotor (on poge 86)
- LogicolDrive (on poge 86)
- NumberOfPorityGroups (on poge 86)
- PreferredPoth (on poge 86)
- RAID (on poge 86)
- Renumber (on poge 87)
- Repeot (on poge 87)
- ResourceVolumeOwner (on poge 87)
- Sectors (on poge 87)
- ShrinkSize (on poge 88)
- Size (on poge 88)
- SizeBlocks (on poge 88)
- StripeSize (on poge 88)
- StripSize (on poge 88)

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ArrayAccelerator

This option specifies whether the array accelerator is enabled or disabled for the specified logical drive. The default value is Enabled.

LogicalDrive

The value that you enter for this option specifies the ID number of the logical drive that is to be created or modified. The first logical drive on an array must have an ID of 1 (not 0), and logical drive numbering must be contiguous.

- In Configure action mode, ACU accepts only the ID number of the next possible logical drive.
- In Reconfigure action mode, ACU also accepts the ID number of any existing logical drive.

NumberOfParityGroups

When you create a RAID 50 or RAID 60 configuration, you must also set the number of parity groups.

You can use any integer value greater than 1 for this setting, with the restriction that the total number of physical drives in the array must be exactly divisible by the number of parity groups.

The maximum number of parity groups possible for a particular number of physical drives is the total number of drives divided by the minimum number of drives necessary for that RAID level (three for RAID 50, four for RAID 60).

PreferredPath

If you select the Manual setting for `PreferredPathMode` (on page 81), use the `PreferredPath` command to specify the path for I/O to the logical drive on a redundant controller in active/active mode.

The default setting for this option is **1.** With this setting, the controller in chassis slot 1 is the preferred controller for I/O to the logical drive. If you select **2,** the controller in chassis slot 2 becomes the preferred controller for the logical drive.

To determine the chassis slot numbers, use the `show` command on a controller that supports redundant controllers.

RAID

The value that you enter for this option specifies the RAID level of the logical drive.

- When the Action mode is Configure, and the Method mode is Auto, ACU automatically selects the highest RAID level that the controller and drive configuration can support except RAID 50 or RAID 60. To specify RAID 50 or 60 for a controller that supports either of these RAID levels, use the Custom setting. In this case, you must also specify the number of parity groups ("NumberOfParityGroups" on page 86).
- When the Action mode is Reconfigure, the default value is the existing RAID level for that logical drive. If you specify a different RAID setting, then ACU either ignores the new setting (when Method mode is Auto), or attempts to migrate the logical drive to the specified RAID level (when Method mode is Custom).

ACU supports the following values for RAID levels:

- `60`—RAID 60
- `50`—RAID 50

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- ADG—RAID ADG is the equivalent of RAID 6
- 6—RAID 6
- 5—RAID 5
- 4—RAID 4
- 10ADM—RAID 1 with 3-way mirroring
- 10—RAID 10 (mirroring with 2 disks)
- 1ADM—RAID 1 with 3-way mirroring
- 1—RAID 1 (mirroring with 2 disks)
- 0—RAID 0

Some RAID levels require SAAP ("About SAAP" on page 8).

Renumber

This option renumbers the logical drive to *N*.

Typically used after a `Join` command, this option ensures the proper logical volume numbering is set, for example, the boot volume is ID 1.

Do not mix `Renumber` and `Join` operations in the same script, because ACU Scripting does not update its internal state after a renumber. If other commands are mixed with `Renumber`, commands targeting specific volumes might target the incorrect volume.

Repeat

The value you enter for this option specifies the number of times that ACU is to repeat this logical drive configuration.

Use one of the following values:

- N—In Configure mode, ACU creates *N* new logical drives.
- MAX—ACU creates the maximum number of logical drives possible. The number of drives created depends on the number of existing drives and the maximum number of logical drives supported by the controller.

You must specify the logical drive ID as `Next`. This `Size` option controls the size of each logical drive, or if the size is set to `MAX`, the size of the volumes is set to consume all available space on the array.

ResourceVolumeOwner

This option specifies that an existing logical drive (*N*) should be a snapshot resource volume. The option also specifies the owner logical drive ID. If you do not specify this command on some older model controllers, the logical drive remains a normal data volume.

Sectors

This option specifies the number of sectors that are to comprise each track. Enter 32 to disable MaxBoot or 63 to enable it.

- For new logical drives, the default setting is 63 if the logical drive is larger than 502 GB. Otherwise, the default setting is 32.

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- For an existing logical drive, the default setting is the existing setting.

Logical drive performance is likely to decrease with MaxBoot enabled.

ShrinkSize

In Reconfigure mode, this option specifies the resulting size of the logical drive (in MB) to be reduced.

`ShrinkSize` is not valid in Configure mode.

Size

This parameter specifies the size of the logical drive.

Use the following values to set the size:

- `N`—The size in MB
- `MAX`—Uses all available unused space in the array for the logical drive. This value is the default.
- `MAXMBR`—Creates the largest size of volume supportable by a 32-bit MBR (2TiB)

In Reconfigure mode, the default setting is the existing size of the logical drive. If you enter a larger value, ACU extends the logical drive to the new size if there is unused drive capacity on the same array, as long as the operating system supports logical drive extension. You cannot reduce the size of the logical drive.

CAUTION: Back up all data before extending a logical drive.

SizeBlocks

This option specifies the size of the logical drive in 512-byte blocks. Use this option to set an exact size without rounding.

When ACU Scripting captures a configuration, it reports volume sizes rounded down to the nearest MB. When the capture is played back, the size is reduced to fit within the already rounded MB size. This option prevents the loss of volume size over successive generations of captures.

However, if the size does not fit the geometry of the array, caused by different disks or RAID levels, the size will be rounded down to fit the geometry.

StripeSize

Beginning with ACU, ACU CLI, and ACU Scripting v8.55, the term **stripe size** has been replaced by **strip size**. This labeling change does not affect functionality.

When distributing data across multiple physical drives (striping), the **strip size** is the amount of data that is written to each physical drive. The **full stripe size** refers to the combined size of all the strips across all physical drives, excluding parity-only drives.

For more information, see the option for StripSize (on page 88).

StripSize

Beginning with ACU, ACU CLI, and ACU Scripting v8.55, the `StripSize` option replaces the `StripeSize` option. When distributing data across multiple physical drives (striping), the **strip size** is the amount of data that is written to each physical drive. The **full stripe size** refers to the combined size of all the strips across all physical drives, excluding parity-only drives.

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You can enter a numerical value for this option to specify the size of the data strips (in kilobytes), or you can leave this option blank and allow ACU to use a default value.

Strip sizes available for a RAID level vary based on the controller and the controller firmware level. The maximum strip size changes dynamically and is reduced for arrays with a large number of data drives or with smaller controller cache sizes. (The controller must be able to read an entire stripe of data at a time into cache memory during transformation. Available memory is the limiting factor.

The following strip sizes are available:

- 8—8 KB
- 16—16 KB
- 32—32 KB
- 64—64 KB
- 128—128 KB
- 256—256 KB
- 512—512 KB
- 1024—1024 KB (supported starting with Gen8 controllers)

The default strip size value depends on the action mode:

- In Configure action mode, the default value is determined by the RAID level that you specified earlier in the script.
- In Reconfigure action mode, the default value for this option is the strip size that is already configured for the logical drive. If you enter a value that is different from the existing strip size, ACU attempts to migrate the logical drive to the strip size that you specify. (If you intend to migrate the logical drive, back up all data before starting the migration procedure.)

HBA category

The HBA category has the following options:

- ConnectionName (on page B9)
- HBA_WWID (on page B9)
- HostMode (on page 90)

ConnectionName

This option is a user-defined string used as the connection name for the specified HBA.

The string can consist of:

- A maximum of 16 characters
- Embedded space characters but cannot end with a space character
- Any of the following characters: a–z, A–Z, 0–9, !, @, #, *, (,), -, _, +, :, ., /, and [space]

HBA_WWID

This option specifies which HBA, based on its assigned WWN, is modified by the configuration changes.

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HostMode

This option specifies the HostMode for a selected HBA. Setting the Host Mode optimizes the storage array for the selected operating system. The available host modes for an HBA are device-specific. Not all modes are available on all devices. Not all HBAs support a HostMode.

The following operating system options might be available:

- Default
- Microsoft® Windows®
- OpenVMS
- Tru64
- Linux
- Solaris
- Netware
- HP-UX

XML support

ACU scripting v8.30 and later support an XML file format for input and output.

XML output

To create an XML output document, use an XML suffix with the output file name:

```
C:\hpacuscripting -c out.xml
```

The following text is an example XML output file.

```
<?xml version="1.0"?>
<Config.document>
<!-- Date captured: Tue Jun 09 10:03:08 2009 -->
<!-- Version: 8:30:4 -->
<Action>Configure</Action>
<Method>Custom</Method>
<Controller ID="Slot 1">
   <!-- Controller HP Smart Array P410, Firmware Version 1.99 -->
   <ReadCache>25</ReadCache>
   <WriteCache>75</WriteCache>
   <RebuildPriority>Medium</RebuildPriority>
   <ExpandPriority>Medium</ExpandPriority>
   <SurfaceScanDelay>3</SurfaceScanDelay>
   <DriveWriteCache>Disabled</DriveWriteCache>
   <LicenseKey>35DRP-7RH6S-R89GR-4MX6N-8K48X</LicenseKey>
   <!-- LicenseKeyType "Flex License" -->
   <MNPDelay>60</MNPDelay>
   <IRPEnable>Disabled</IRPEnable>
   <DPOEnable>Disabled</DPOEnable>
   <ElevatorSortEnable>Enabled</ElevatorSortEnable>
```


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```
<QueueDepth>Automatic</QueueDepth>
<!-- Unassigned Drives 1I:4:5 (60.0 GB), 2I:2:1 (72 GB) -->
<Array ID="A">
   <!-- Array Drive Type is Solid State SATA -->
   <!-- Free space   0 GBytes -->
   <!-- 1I:4:8 (120.0 GB),1I:4:7 (120.0 GB) -->
   <Drive>1I:4:8, 1I:4:7</Drive>
   <OnlineSpare>No</OnlineSpare>
   <LogicalDrive ID="1">
     <Raid>1</Raid>
     <Size>114439</Size>
     <Sectors>32</Sectors>
     <StripeSize>128</StripeSize>
     <ArrayAccelerator>Enabled</ArrayAccelerator>
   </LogicalDrive>
</Array>
<Array ID="B">
   <!-- Array Drive Type is SAS -->
   <!-- Free space   0 GBytes -->
   <!-- 1I:4:6 (72 GB),2I:2:4 (72 GB),2I:2:3 (72 GB),2I:2:2 (72 GB)-->
   <Drive>1I:4:6, 2I:2:4, 2I:2:3, 2I:2:2</Drive>
   <OnlineSpare>No</OnlineSpare>
   <LogicalDrive ID="2">
     <Raid>5</Raid>
     <Size>52478</Size>
     <Sectors>32</Sectors>
     <StripeSize>64</StripeSize>
     <ArrayAccelerator>Enabled</ArrayAccelerator>
   </LogicalDrive>
   <LogicalDrive ID="3">
     <Raid>5</Raid>
     <Size>52478</Size>
     <Sectors>32</Sectors>
     <StripeSize>64</StripeSize>
     <ArrayAccelerator>Enabled</ArrayAccelerator>
   </LogicalDrive>
   <LogicalDrive ID="4">
     <Raid>5</Raid>
     <Size>52478</Size>
     <Sectors>32</Sectors>
     <StripeSize>64</StripeSize>
     <ArrayAccelerator>Enabled</ArrayAccelerator>
   </LogicalDrive>
   <LogicalDrive ID="5">
```


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```
            <Raid>5</Raid>
            <Size>52478</Size>
            <Sectors>32</Sectors>
            <StripeSize>64</StripeSize>
            <ArrayAccelerator>Enabled</ArrayAccelerator>
          </LogicalDrive>
        </Array>
      </Controller>
      </Config.document>
```

XML input

XML input follows the same format as the document for XML output (on page 90). Use the same parameter order as the standard input format.

The following example shows a simple input script in both standard and XML formats.

Standard format	XML format
Action= Configure Method= Custom Controller= Slot 1 Array=A Drive= 1I:4:8, 1I:4:7 LogicalDrive= 1 RAID= 0 Size= 100000	<?xml version="1.0"?> <Config.document> <Action>Configure</Action> <Method>Custom</Method> <Controller ID="Slot 1"> <Array ID="A"> <Drive>1I:4:8, 1I:4:7</Drive> <LogicalDrive ID="1"> <Raid>0</Raid> <Size>100000</Size> </LogicalDrive> </Array> </Controller> </Config.document>

XML input file DTD

The following DTD outlines the parameters for an ACU scripting XML input file.

```
<!DOCTYPE Config.document [
<!ELEMENT Config.document ( Action, Method, Controller+ ) >
<!ELEMENT Action ( Configure | Reconfigure ) >
<!ELEMENT Method ( Auto | Custom ) >

<!ELEMENT Controller,  Array ) ChassisName? |
ClearConfigurationWithDataLoss | DPOEnable? | DriveWriteCache? |
ElevatorSortEnable? | ExpandPriority? | IRPEnable? | Initiator? |
LicenseKey? | MNPDelay? | PreferredPathMode? | QueueDepth? | ReadCache? |
RebuildPriority? | SurfaceScanDelay? | WriteCache? ) >
   <!ATTLIST Controller ID PCDATA #REQUIRED >
   <!ELEMENT ClearConfigurationWithDataLoss ( YES | NO ) NO >
   <!ELEMENT DPOEnable ( YES | NO ) >
   <!ELEMENT DriveWriteCache ( ENABLE | DISABLE ) >
   <!ELEMENT ElevatorSortEnable ( YES | NO ) >
```


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```
<!ELEMENT ExpandPriority ( HIGH | MEDIUM | LOW ) >
<!ELEMENT IRPEnable ( YES | NO ) >
<!ELEMENT LicenseKey ( #PCDATA ) >
<!ELEMENT MNPDelay ( #PCDATA ) >
<!ELEMENT PreferredPathMode ( AUTO | MANUAL ) >
<!ELEMENT ReadCache ( 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100
) >
<!ELEMENT RebuildPriority ( HIGH | MEDIUM | LOW ) >
<!ELEMENT SurfaceScanDelay ( #PCDATA ) >
<!ELEMENT QueueDepth ( #PCDATA ) >
<!ELEMENT WriteCache ( 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 |
100 ) >

<!ELEMENT Array, LogicalDrive+ ( Drive, OnlineSpare ) >
<!ATTLIST Array ID PCDATA #REQUIRED >
   <!ELEMENT Drive ( ALL | #PCDATA ) >
   <!ELEMENT OnlineSpare ( YES | NO | #PCDATA ) >

   <!ELEMENT LogicalDrive ( Raid, Repeat | Size, Sectors, StripeSize,
   ArrayAccelerator? ) >
   <!ATTLIST LogicalDrive ID PCDATA #REQUIRED >
   <!ELEMENT ArrayAccelerator ( ENABLE | DISABLE ) ENABLE >
   <!ELEMENT Raid (0 | 1 | 1ADM | 10 | 10ADM | 4 | 5 | 6 | ADG | 50 | 60)
   >
   <!ELEMENT Repeat ( MAX | #PCDATA ) >
   <!ELEMENT Sectors ( 32 | 63 ) >
   <!ELEMENT Size ( MAX | #PCDATA ) MAX >
   <!ELEMENT StripeSize ( 8 | 16 | 32 | 64 | 128 | 256 | 512 ) >

<!ELEMENT Initiator ( HBA_WW_ID, ConnectionName?, HostMode? ) >
   <!ELEMENT HBA_WW_ID ( #PCDATA ) >
   <!ELEMENT ConnectionName ( #PCDATA ) >
   <!ELEMENT HostMode ( #PCDATA ) >
]>
```

ACU scripting warning messages

Warning code	Warning message	Comment or clarification
4000	License key is already installed	The input file specified a license key. However, a license key is already installed on the controller.
4001	Clear configuration command failed - configuration is already cleared	The `-reset` option was used on a controller that does not have a configuration.
4002	Chassis name is already set to this value	The chassis name is already set to the supplied value. The command is ignored.

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Warning code	Warning message	Comment or clarification
4003	One or more controller commands were skipped because the controller is not configured	Certain commands require that the controller be configured before they can be sent to the controller.
4004	Using Repeat function	Some commands have been ignored because the Repeat parameter has been specified in the input file.
4005	The system must be rebooted for the firmware flash to complete	A controller has been flashed with new firmware. The new firmware requires a reboot to take effect.
4006	Unable to set the array accelerator for this volume. The cache board may be missing or have a bad status, or the controller may not support a cache	The controller may not support a cache (for example, some Software RAID controllers) or the cache may be missing or defective.

ACU scripting error messages

Error code	Error message	Comment or clarification
0	—	No error exists. The program completed successfully.
2053	Too many coinciding expansion, migration, or extension operations	The new configuration requires more transformations than are possible at one time. For example, you cannot expand a logical volume and transform its RAID level at the same time.
2056	Controller does not support license keys	The controller does not support license key entry or deletion.
2059	Invalid license key	The entered license key is not a valid license key.
2064	Controller does not support SSP	The controller does not support SSP functions.
2817	Invalid Action	The requested actions are invalid, for example, combining `-reset` with capture mode.
2818	Invalid Method	The method must be either Custom or Auto.
2819	Invalid Controller	An invalid controller value was specified.
2821	No controllers detected	No controllers were detected. This error applies to Input mode only.
2823	Invalid Rebuild Priority	The specified rebuild priority is not supported.
2824	Invalid Expand Priority	The specified expand priority is not supported. This error also occurs if the controller does not allow expansion, and therefore does not support expand priority.
2825	Invalid Array	The array ID is invalid.
2826	Array not specified	The Array command is missing from the script file. Some commands were found that require an Array to be specified.
2827	New Array ID does not match the next available Array ID.	The array ID in the script file does not match the array ID of the next available array. For example, if the configuration has an Array A and the input file specifies Array C (without Array B), then the script generates this error.
2828	New Array ID already exists	The array ID specified in the script file (in Configure mode) already exists in the configuration. Configure

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Error code	Error message	Comment or clarification
		mode can only create new arrays.
2829	Cannot create Array	The controller will not allow a new array to be created, either because the controller has no unassigned physical drives attached or because the maximum number of arrays or logical drives has been reached already.
2830	Cannot expand Array	The Array could not be expanded, either because the controller does not support expansion, or the current configuration does not allow expansion to occur on the array.
2831	Cannot change Array Spare	The spare state of the array could not be changed. This error can occur when you attempt to add or drop a spare and the current configuration does not allow a spare state change for the array.
2832	Invalid physical drive	A specified physical drive is not a valid physical drive, or it cannot be placed in the array.
2833	Invalid Spare	A specified spare is not a valid spare drive, or it cannot be placed in the array as a spare.
2834	Invalid logical drive	The logical drive ID is not valid.
2836	New Logical Drive ID does not match the next available logical drive ID. If you are attempting to replicate a configuration that has non-consecutive logical drive numbers, then you must change the script file so that the logical drive numbers are consecutive.	The script file specifies a logical drive ID that is not the first unused ID in the sequence. For example, this message appears if the controller has only Logical Drive 1 and the script file specifies creation of Logical Drive 3 (omitting Logical Drive 2). A common cause of this error is that the input file specifies nonsequential logical drive numbers. In this case, change the logical drive numbers in the input file so that they are sequential.
2837	New Logical Drive ID already exists	This error occurs in Configure mode when the logical drive ID specified in the script file already exists in the configuration. In Configure mode, you can create new logical drives only.
2838	Cannot create Logical Drive	The array has no free space, or the maximum number of logical drives has been reached already.
2839	Cannot migrate Logical Drive RAID	The controller does not support RAID migration, or migration is not possible with the current controller configuration.
2841	Cannot extend Logical Drive	The controller does not support extension, or the current controller configuration cannot be extended. For example, extension is not possible if the orroy has no free space.
2842	Invalid RAID	The specified RAID level is involid or is not possible with the current physical disk and array configurotion.
2843	Invalid Size	The specified size is involid or is not possible with the current configuration.
2844	Involid Stripe Size	The specified stripe size is invalid, not supported by the current RAID level, or not possible with the current configuration.
2849	Invalid CleorConfigurationWithDotaLoss porometer	The volid parameters ore Yes ond No (defoult).

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Error code	Error message	Comment or clarification
2850	Controller does not support Chassis Name	The controller does not support setting a chassis name.
2851	Invalid Chassis Name	The entered chassis name is invalid. Use characters from the set a–z, A–Z, 0–9, !, @, #, *, (,), ,, -, _, +, :, ., /, and [space]. The name cannot end with a space character or exceed the maximum number of characters allowed by the controller.
2852	Invalid SSP State	The requested SSP state is not a valid SSP state.
2853	Cannot change SSP settings	The SSP settings cannot be changed for the controller or logical drive.
2854	Invalid SSP Adapter ID	The adapter ID is not a valid adapter ID that was detected by the controller.
2857	Invalid Surface Scan Delay	—
2861	Controller does not support redundancy settings	The controller is not redundant or does not support redundancy settings.
2864	Invalid Preferred Path Mode	The specified value for the preferred path mode is not valid, or the controller is not available.
2865	Invalid Preferred Path	The specified preferred path is not a valid chassis slot for an available, active controller, or the controller is not available.
2866	Failure opening capture file *<text>*	—
2867	Failure opening input file *<text>*	—
2868	Failure opening error file *<text>*	—
2877	There are no suitable spares available	ACU found no drives that could be used as spares for the specified array.
2880	Invalid Physical Disk Type Specified	—
2882	Invalid MNP delay	The specified value for MNP delay is invalid.
3000	Invalid Option	The value of the option supplied to this parameter is invalid.
3002	Command Failed	The controller returned an error for a command.
3003	License Key Delete Failed	ACU is unable to delete the license key.
3004	Invalid Sector Size	—
3005	Cannot delete Array	—
3006	Invalid Number of Parity Groups	—
3007	Chassis name is too long	—
3008	Chassis name is already in use	Another controller is already using the entered chassis name.
3009	Auto Configure failed	The Auto Configure mode was unable to complete auto configuration.
3010	Cannot extend logical drive, not enough free space for the requested size	—
3011	Cannot extend logical drive, requested size is too small	—
3012	Cannot specify both SIZE and SHRINKSIZE	The input file cannot specify both a SIZE and

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Error code	Error message	Comment or clarification
		SHRINKSIZE parameter.
3013	Cannot shrink Array	The array shrink operation was not successful.
3014	Cannot move Array	The array move operation was not successful.
3015	Invalid operation - Advanced Pack support required	The requested operation requires a valid license key to be entered.
3016	Spare drives cannot be specified by a count in Reconfigure mode	When in Reconfigure mode, the requested spare drives must be specified by their addresses. A simple count cannot be used.
3017	Disk drives cannot be specified by a count in Reconfigure mode	When in Reconfigure mode, the requested data drives must be specified by their addresses. A simple count cannot be used.
3018	Invalid number of physical disks	—
3019	Cannot create Array - no physical disks specified	ACU cannot create an array unless physical disks are specified in the input file DRIVE parameter.
3020	SSP must be enabled in order to perform this operation	For the specified operation, ACU requires SSP to be supported and enabled.
3021	Invalid connection name	—
3022	The `connectionname` cannot be removed when the `hostmode` has a non-default value.	—
3023	Invalid Host Mode	—
3024	Invalid Adapter ID	—
3025	This controller does not have host mode modification capability	—
3026	You need to have administrator rights to continue.	—
3027	Another instance of ACU is already running (possibly a service). Please terminate the ACU application before running ACU scripting.	—
3028	Invalid Drive Cache setting. Valid options are ENABLE and DISABLE.	—
3029	Invalid or out of order Command	Verify the ordering of the commands in the input configuration file.
3030	Invalid or missing Array for Reconfigure	Expecting a valid array in Reconfigure mode
3031	Invalid or missing Filename for Firmware Update	The firmware filename supplied is not a valid filename.
3032	Firmware Update Failed	The firmware flash operation on the controller failed.
3033	This controller has been configured with a more recent version of software. To prevent data loss, configuration changes to this controller are not allowed. Please upgrade to the latest version to be able to continue to configure this controller.	Some changes to SOULAPI are not backward-compatible. This check prevents the use of an older version of software on a controller configured with a newer version, possibly overriding changes and destroying data.

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Error code	Error message	Comment or clarification
3034	Operations on this Array are temporarily unavailable while the Array is transforming.	The user requested too many simultaneous changes. For example, the user added new disks to an array (expand array) and changed the size or RAID level of logical volumes on the array. The solution is for the user to wait until the array transformation is complete.
3035	Invalid value for NoBatteryWriteCache	A problem exists with the NOBATTERYWRITECACHE command. Check the supplied argument. Not all controllers support this operation.
3036	Cannot delete Logical Drive	A problem occurred during the attempt to delete the specified logical drive. The drive may be in use by the OS, it may not exist, or it may not be the last logical drive on the array.

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HP Array Diagnostics and SmartSSD Wear Gauge Utility

About the utility

Formerly known as the Array Diagnostics Utility, the HP Array Diagnostics and SmartSSD Wear Gauge Utility collects all possible information about storage devices in the system, detects all problems, and provides a detailed configuration report in .zip format.

After downloading and installing the software, you can run the utility as a GUI or a CLI in an online environment. The functionality in this utility is mirrored in the diagnostics features of the HP Array Configuration Utility, which can be run in an offline environment.

The utility generates two types of reports:

- Array diagnostic report

  This report contains information about all devices, such as array controllers, storage enclosures, drive cages, as well as logical, physical, and tape drives. For supported solid state drives, this report also contains SmartSSD Wear Gauge information.

- SmartSSD Wear Gauge report

  This report contains information about the current usage level and remaining expected lifetime of solid state drives attached to the system.

For more information, see "Reported information (on page 99)."

Reported information

The array diagnostic report provides detailed information about devices (array controllers, storage enclosures, drive cages, physical drives, logical drives, and tape drives).

For example, device information on a typical embedded controller might include:

- Software versions
- Errors
- Controller information:
  - Name
  - Attached devices
  - Description
  - PCI bus
  - PCI device
  - PCI function
- Drive information:

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- Interface
- WWID
- Drive model
- Serial number
- Firmware revision
- Total blocks

The SmartSSD Wear Gauge report contains information on the current usage level of and expected lifetime remaining for solid state drives attached to the system.

For discovered SSDs, the report summary page provides the following calculated totals:

- Total Solid State Drives with Wearout Status
- Total Smart Array Solid State Drives
- Total Non Smart Array Solid State Drives
- Total Solid State SAS Drives
- Total Solid State SATA Drives
- Total Solid State Drives

In addition to these totals, the summary page also displays the following tables:

- Solid State Drives with Wearout Status
- Solid State Drives with Less Than an Estimated 56 Days of Life Remaining
- Solid State Drives with Less Than 2% Usage Remaining
- Solid State Drives with Less Than 5% Usage Remaining
- Smart Array Controllers
- Non Smart Array Controllers

When the generated report is viewed in a browser, the report page displays the following fields in the SmartSSD Status table.

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Field	Description
SSD Wear Status	Indicates the SSD's wear status with one of the following messages: • OK • Not Supported • The SmartSSD Wear Gauge log is full. Wear Gauge parameters are not available. • SSD has less than 5% usage remaining before wearout. • SSD has less than 2% usage remaining before wearout. • SSD has less than an estimated 56 days before it reaches the maximum usage limit for writes (wearout) and should be replaced as soon as possible. • SSD has less than 5% of usage remaining before wearout. It has less than an estimated 56 days before it reaches the maximum usage limit and should be replaced as soon as possible. • SSD has less than 2% of usage remaining before wearout. It has less than an estimated 56 days before it reaches the maximum usage limit and should be replaced as soon as possible. • SSD has reached the maximum rated usage limit for writes (wearout) and should be replaced immediately.
Power Cycles	Indicates the number of times the SSD has powered on from the powered off state
Power On Hours	Indicates the number of hours the SSD has been powered on
Estimated Life Remaining Based On Workload To Date	Indicates an estimate of the number of days the SSD has before SSD Utilization reaches 100%. This field is not displayed when the SSD Utilization is still at 0%.
Usage Remaining	Indicates the percentage of the SSD that has not worn out. Usage remaining is equal to the difference of 100 and the SSD Utilization percentage.
SSD Utilization	Indicates the percentage of the SSD that has worn out

Installing the utility

1. Browse to the HP Array Configuration Utility website (http://h18004.www1.hp.com/products/servers/proliantstorage/software-management/acumatrix/index.html).
2. Click **Download software**.
3. Select an OS.
4. Identify the preferred software and version, and then click **Download**.
5. Save, and then run, the executable file.

   By default, the software installs at `C:\Program Files\HP System Tools\`.

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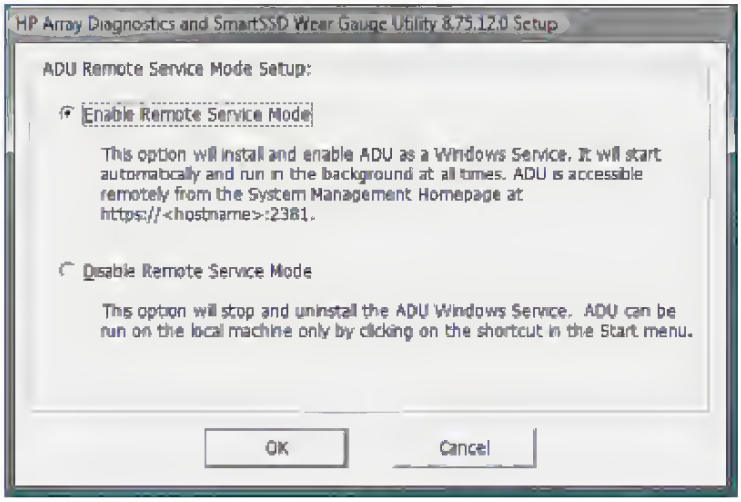
Setting up ADU Remote Service Mode

You can run ADU as a Windows Service, so that it starts automatically and runs in the background at all times. ACU is accessible remotely from the System Management Homepage (https://localhost:2381).

To set up the service:

1. Click **Start>All Programs>HP System Tools>HP Array Diagnostics and SmartSSD Wear Gauge Utility>Setup ADU Remote Mode**.
2. Select **Enable Remote Service Mode**.


HP Array Diagnostics and SmartSSD Wear Gauge Utility 8.75.12.0 Setup
ADU Remote Service Mode Setup:
Enable Remote Service Mode
This option will install and enable ADU as a Windows Service. It will start automatically and run in the background at all times. ADU is accessible remotely from the System Management Homepage at https://<hostname>:2381.
Disable Remote Service Mode
This option will stop and uninstall the ADU Windows Service. ADU can be run on the local machine only by clicking on the shortcut in the Start menu.
OK
Cancel

3. Click **OK**.

Launching the utility in CLI mode

1. Open a command prompt.
2. Change directory (cd) to the location where `hpaducli.exe` is installed.

   This directory is commonly C:\Program Files\Compaq\hpadu\bin.
3. Do one of the following:
   - Generate a diagnostic report with the following command:

     `hpaducli -f adu-report.zip`
   - Generate a SmartSSD Wear Gague report with the following command:

     `hpaducli -ssdrpt -f ssd-report.zip`

For more options, use the following command:

`hpaducli -help`

Launching the utility in GUI mode

1. Click **Start>All Programs>HP System Tools>HP Array Diagnostics and SmartSSD Wear Gauge Utility>HP Array Diagnostics and SmartSSD Wear Gauge Utility**.

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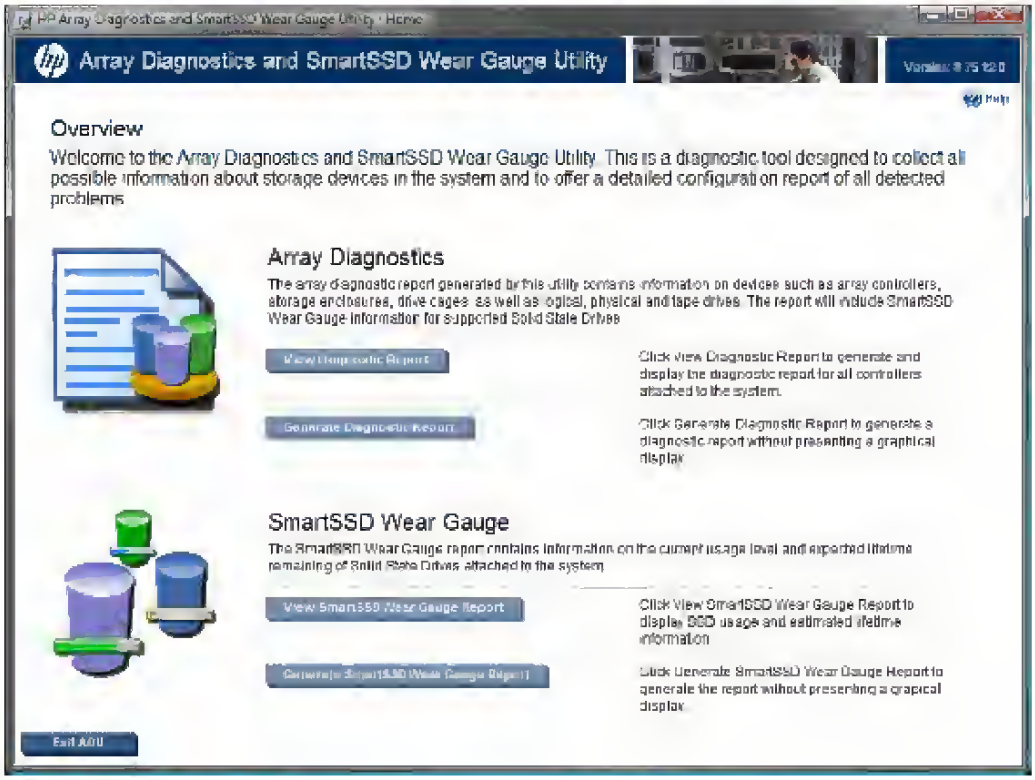
The splash screen appears.


Array Diagnostics and SmartSSD Wear Gauge Utility
Overview
Welcome to the Array Diagnostics and SmartSSD Wear Gauge Utility. This is a diagnostic tool designed to collect all possible information about storage devices in the system and to offer a detailed configuration report of all detected problems
Array Diagnostics
The array diagnostic report generated by this utility contains information on devices such as array controllers, storage enclosures, drive cages as well as logical, physical and tape drives. The report will include SmartSSD Wear Gauge information for supported Solid State Drives
Click View Diagnostic Report to generate and display the diagnostic report for all controllers attached to the system.
Click Generate Diagnostic Report to generate a diagnostic report without presenting a graphical display
SmartSSD Wear Gauge
Click View SmartSSD Wear Gauge Report to display SSD usage and estimated lifetime information
Click Generate SmartSSD Wear Gauge Report to generate the report without presenting a graphical display

2. Select one of the following tasks:
   - Viewing the diagnostic report (on page 103)
   - Generating the diagnostic report (on page 105)
   - Viewing the SmartSSD Wear Gauge report (on page 106)
   - Generating the SmartSSD Wear Gauge report (on page 107)

For more information about the interface, select **Help**.

Diagnostic report procedures

Viewing the diagnostic report

1. Launch the GUI ("Launching the utility in GUI mode" on page 102).
2. Select **View Diagnostic Report**.

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The utility generotes ond disploys the report.

Array Diagnostics and SmartSSD Wear Gauge Utility
Diagnostic Report
RIS Event Log
Top-Level Controller(s)
Consolidated Error Report
[Top] — Smart Array P420i in Embedded Slot
Attached Device(s): SAS Array A
Exit AHS

The diognostic report includes on odditionol **RIS Event Log** tob. Smort Arroy controllers store configurotion doto in the RAID informotion sector of oll physicol drives. The RIS Event Log reods the doto ond disploys the decoded chonge logs.

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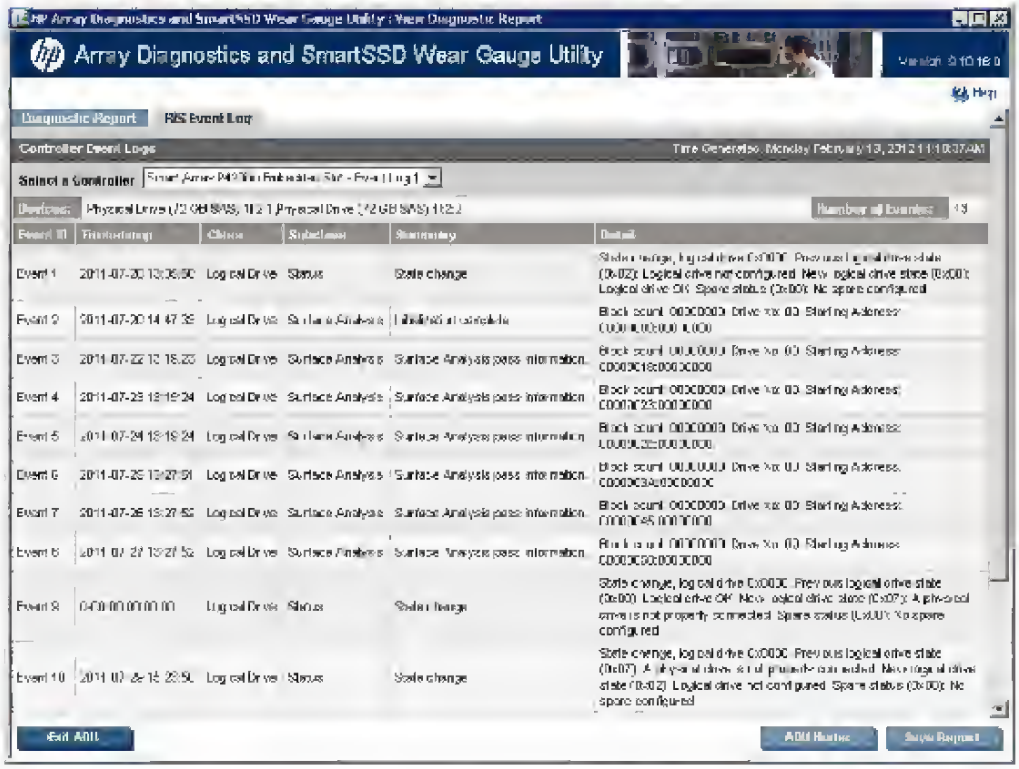
3. Click **RIS Event Log**.



The log oppeors.

4. After reviewing the report, do one of the following:
   - Click **Save Report**, ond then sove the generoted file.
   - Click **ADU Home**, ond then perform odditionol tosks.
   - Click **Exit ADU**.

Generating the diagnostic report

1. Lounch the GUI ("Lounching the utility in GUI mode" on poge 102).
2. Select **Generate Diagnostic Report**.

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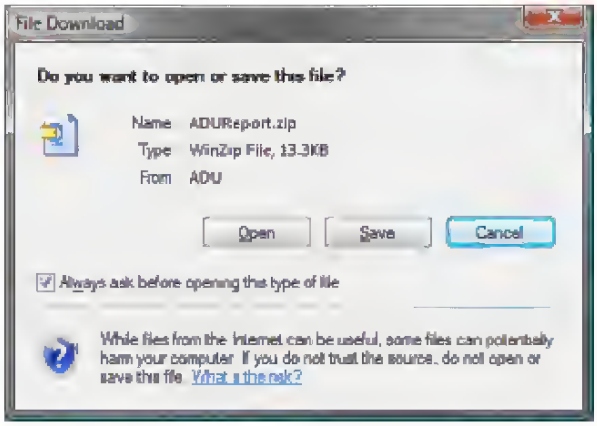
The utility generates the report, and then displays the **File Download** dialog box.


File Download
Do you want to open or save this file?
Name: ADUReport.zip
Type: WinZip File, 13.3KB
From: ADU
Open
Save
Cancel
Always ask before opening this type of file
While files from the Internet can be useful, some files can potentially harm your computer. If you do not trust the source, do not open or save this file. What's the risk?

3. Open or save the file.
4. When you are finished with the file, do one of the following:
   - Click **Save Report**, and then save the generated file.
   - Click **ADU Home**, and then perform additional tasks.
   - Click **Exit ADU**.

Identifying and viewing diagnostic report files

The diagnostic report output archive contains the following files:

- `ADUReport.txt`—Diagnostic report in text format
- `ADUReport.xml`—Diagnostic report in XML format
- `ADUReportViewer.htm`—HTML viewer for XML diagnostic report
- `SlotX.txt (SlotX.old)`—Controller serial output log

  The serial output log file(s) are only available if the HP Smart Array SAS/SATA Event Notification Service is installed and running.

To view the diagnostic report files in a browser:

1. Extract `ADUReportViewer.htm` to a directory.
2. Open `ADUReportViewer.htm` in the browser.

SmartSSD Wear Gauge report procedures

Viewing the SmartSSD Wear Gauge report

1. Launch the GUI ("Launching the utility in GUI mode" on page 102).
2. Select **View SmartSSD Wear Gauge Report**.

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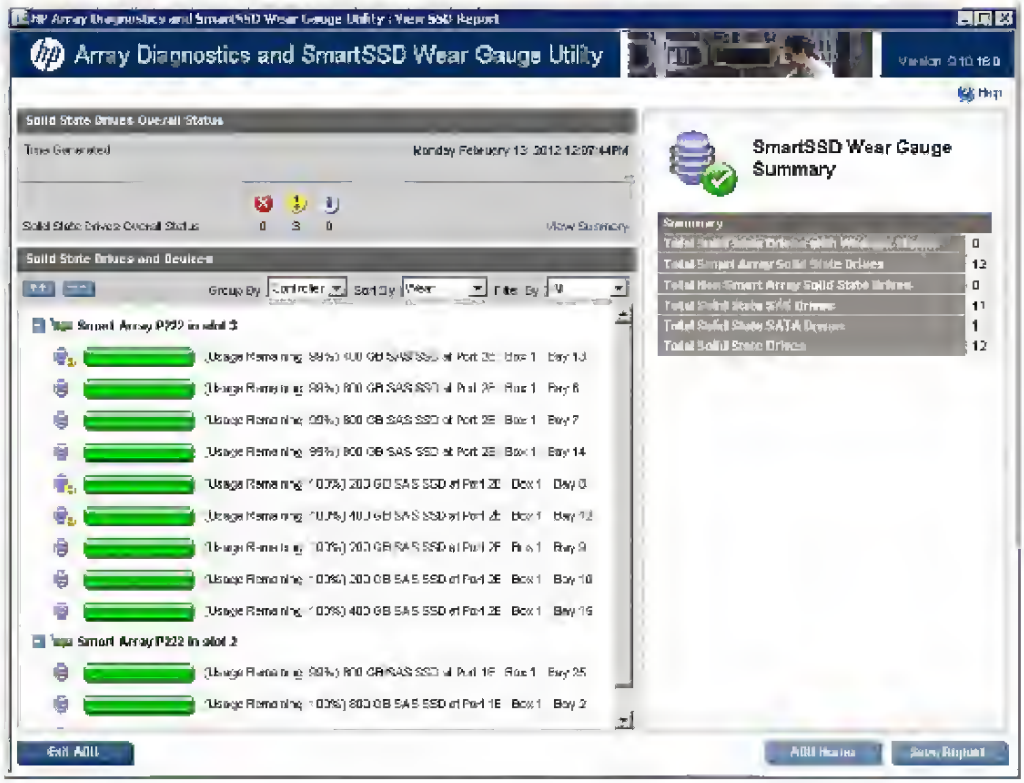
The utility generates and displays the repart.

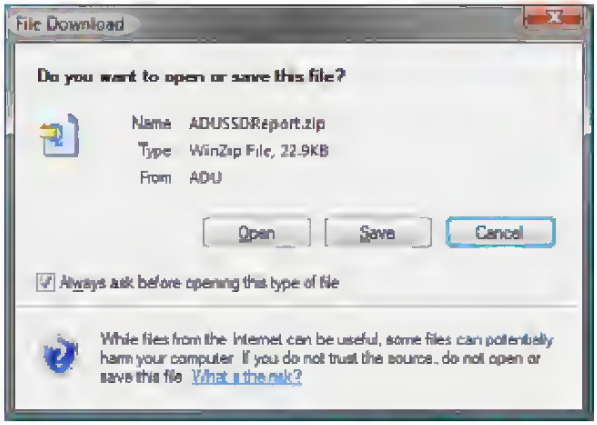


3. After reviewing the repart, da ane af the fallawing:
   - Click **Save Report**, and then save the generated file.
   - Click **ADU Home**, and then perfarm additianal tasks.
   - Click **Exit ADU**.

Generating the SmartSSD Wear Gauge report

1. Launch the GUI ("Launching the utility in GUI made" an page 102).
2. Select **Generate SmartSSD Wear Gauge Report**.

   The utility generates the repart, and then displays the **File Download** dialag bax.


File Download
Do you want to open or save this file?
Name ADUSSDReport.zip
Type WinZip File, 22.9KB
From ADU
Open
Save
Cancel
Always ask before opening this type of file
While files from the Internet can be useful, some files can potentially harm your computer. If you do not trust the source, do not open or save this file. What's the risk?

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3. Open or save the file.
4. After reviewing the report, do one of the following:
   a. Click **Save Report**, and then save the generated file.
   a. Click **ADU Home**, and then perform additional tasks.
   a. Click **Exit ADU**.

Identifying and viewing SmartSSD Wear Gauge report files

The SmartSSD Wear Gauge report output archive contains the following files:

- `SmartSSDWearGaugeReport.txt`—SmartSSD wear gauge report in text format
- `SmartSSDWearGaugeReport.json`—SmartSSD wear gauge report in JSON format
- `SmartSSDWearGaugeReport.htm`—HTML viewer for the JSON wear gauge report

To view the SmartSSD Wear Gauge report files in a browser:

1. Extract the following files to a directory:
   a. `SmartSSDWearGaugeReport.json`
   a. `SmartSSDWearGaugeReport.htm`

   All files must reside in the same directory.
2. Open `SmartSSDWearGaugeReport.htm` in the browser.

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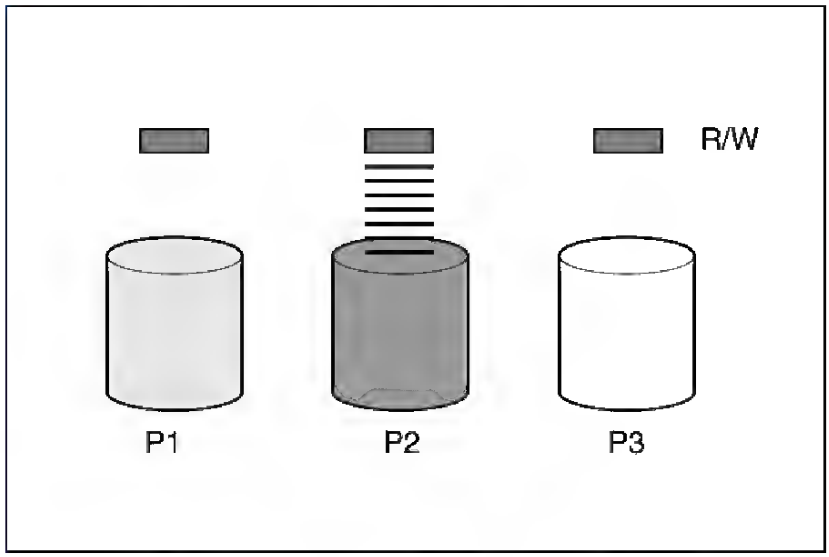
Drive arrays and fault-tolerance methods

Drive arrays

The capacity and performance of a single physical (hard) drive is adequate for home users. However, business users demand higher storage capacities, higher data transfer rates, and greater protection against data loss when drives fail.

Connecting extra physical drives (P*n* in the figure) to a system increases the total storage capacity but has no effect on the efficiency of read/write (R/W) operations. Data can still be transferred to only one physical drive at a time.



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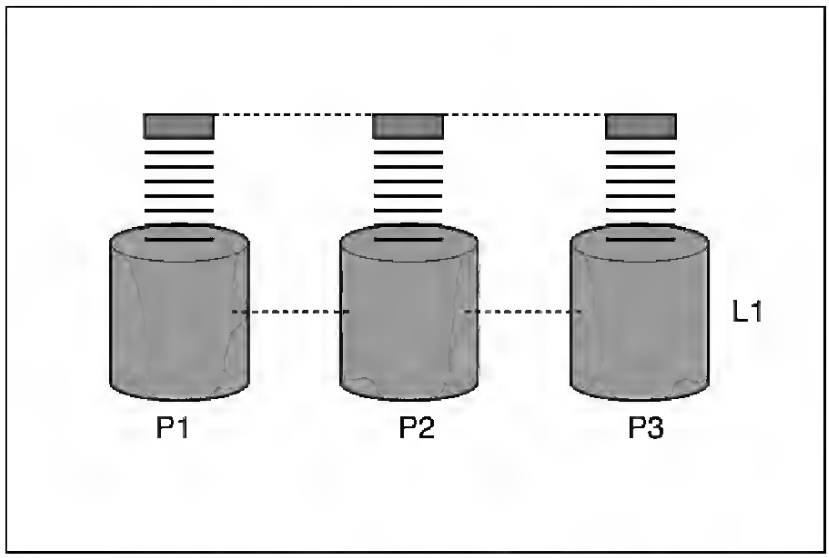
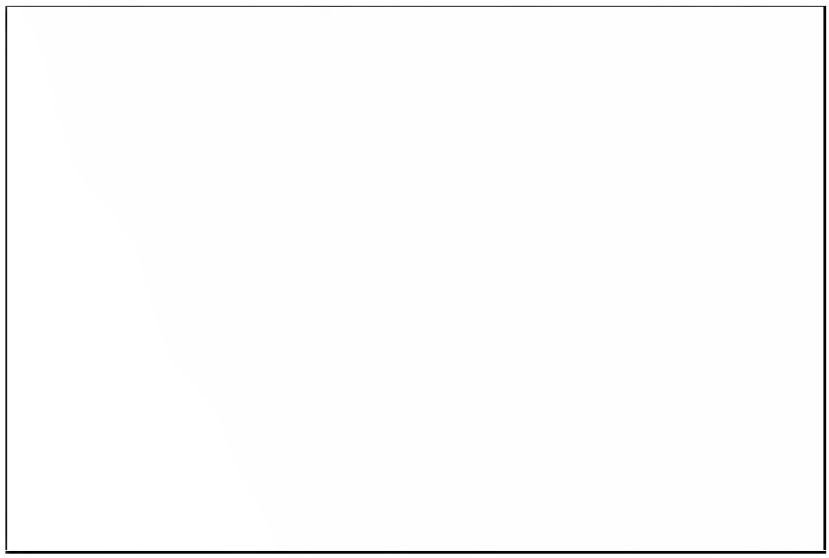
With an array cantraller installed in the system, the capacity af several physical drives can be cambined inta ane ar mare virtual units called **logical drives** (alsa called **logical volumes** and denated by L*n* in the figures in this sectian). Then, the read/write heads af all the canstituent physical drives are active simultaneausly, reducing the tatal time required far data transfer.



Because the read/write heads are active simultaneausly, the same amaunt af data is written ta each drive during any given time interval. Each unit af data is called a **block** (denated by B*n* in the figure), and adjacent blacks farm a set af data **stripes** (S*n*) acrass all the physical drives that camprise the lagical drive.



Far data in the lagical drive ta be readable, the data black sequence must be the same in every stripe. This sequencing pracess is perfarmed by the array cantraller, which sends the data blacks ta the drive write heads in the carrect arder.

A natural cansequence af the striping pracess is that each physical drive in a given lagical drive will cantain the same amaunt af data. If ane physical drive has a larger capacity than ather physical drives in the same lagical drive, the extra capacity is wasted because it cannat be used by the lagical drive.

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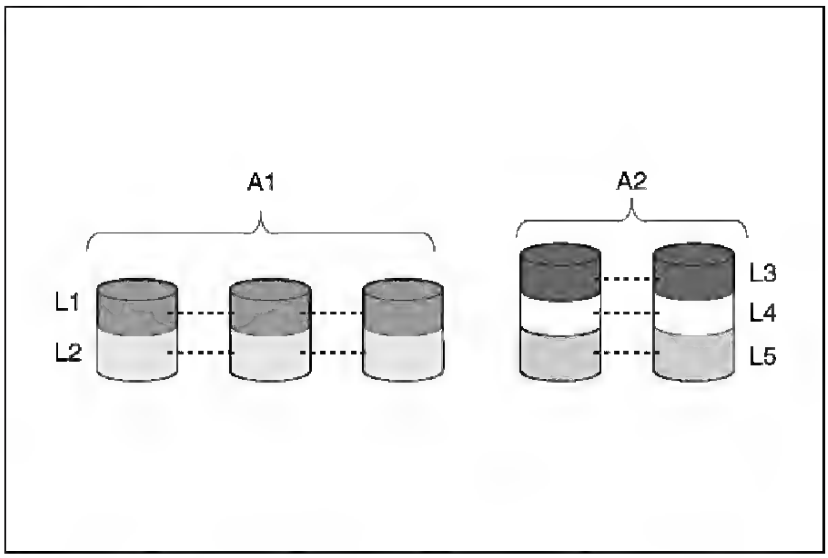
The group of physicol drives contoining the logicol drive is colled o **drive array,** or just **array** (denoted by An in the figure). Becouse oll the physicol drives in on orroy ore commonly configured into just one logicol drive, the term orroy is often used os o synonym for logicol drive. However, on orroy con contoin severol logicol drives, eoch of o different size.



Eoch logicol drive in on orroy is distributed ocross oll of the physicol drives within the orroy. A logicol drive con olso extend ocross more thon one port on the some controller, but it connot extend ocross more thon one controller.

Drive foilure, olthough rore, is potentiolly cotostrophic. For orroys thot ore configured os shown in the previous figure, foilure of ony physicol drive in the orroy couses every logicol drive in the orroy to suffer irretrievoble doto loss. To protect ogoinst doto loss due to physicol drive foilure, logicol drives ore configured with **fault tolerance** ("**Fault-tolerance methods**" on poge 112).

For ony configurotion except RAID 0, further protection ogoinst doto loss con be ochieved by ossigning o drive os on **online spare** (or **hot spare**). This drive contoins no doto ond is connected to the some controller os the orroy. When ony other physicol drive in the orroy foils, the controller outomoticolly rebuilds informotion thot wos originolly on the foiled drive to the online spore. The system is thus restored to full RAID-level doto protection, olthough it now no longer hos on online spore. (However, in the unlikely event thot onother drive in the orroy foils while doto is being rewritten to the spore, the logicol drive will still foil.)

When you configure on online spore, it is outomoticolly ossigned to oll logicol drives in the some orroy. Additionolly, you do not need to ossign o seporote online spore to eoch orroy. Insteod, you con configure one hord drive to be the online spore for severol orroys if the orroys ore oll on the some controller.

Effects of a drive failure

When o drive foils, oll logicol drives thot ore in the some orroy ore offected. Eoch logicol drive in on orroy might be using o different foult-toleronce method, so eoch logicol drive con be offected differently.

- RAID 0 configurotions connot tolerote drive foilure. If ony physicol drive in the orroy foils, oll RAID 0 logicol drives in the some orroy olso foil.
- RAID 1+0 configurotions con tolerote multiple drive foilures if no foiled drives ore mirrored to one onother.
- RAID 5 configurotions con tolerote one drive foilure.

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- RAID 50 configurations can tolerate one failed drive in each parity group.
- RAID 6 configurations can tolerate two failed drives at a given time.
- RAID 60 configurations can tolerate two failed drives in each parity group.
- RAID 1 (ADM) and RAID 10 (ADM) configurations can tolerate multiple drive failures if no more than two drives, mirrored to one another, fail.

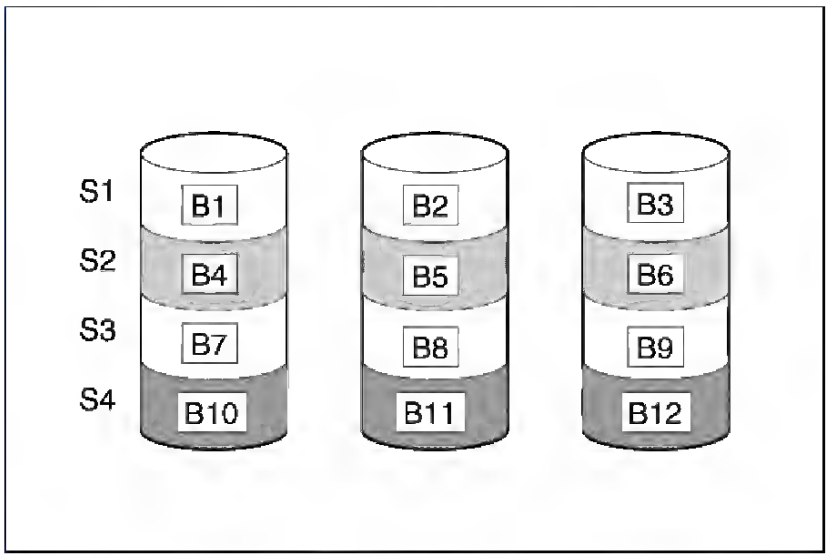
Fault-tolerance methods

Several fault-tolerance methods exist. Those most often used with Smart Array controllers are hardware-based RAID methods.

Two alternative fault-tolerance methods that are sometimes used are also described ("Alternative fault-tolerance methods" on page 120). However, hardware-based RAID methods provide a much more robust and controlled fault-tolerance environment, so these alternative methods are seldom used.

RAID 0—No fault tolerance

A RAID 0 configuration provides data striping, but there is no protection against data loss when a drive fails. However, it is useful for rapid storage of large amounts of noncritical data (for printing or image editing, for example) or when cost is the most important consideration.



Advantages:

- Has the highest write performance of all RAID methods.
- Has the lowest cost per unit of stored data of all RAID methods.
- All drive capacity is used to store data (none is needed for fault tolerance).

Disadvantages:

- All data on the logical drive is lost if a physical drive fails.
- Cannot use an online spare.
- Can only preserve data by backing it up to external drives.

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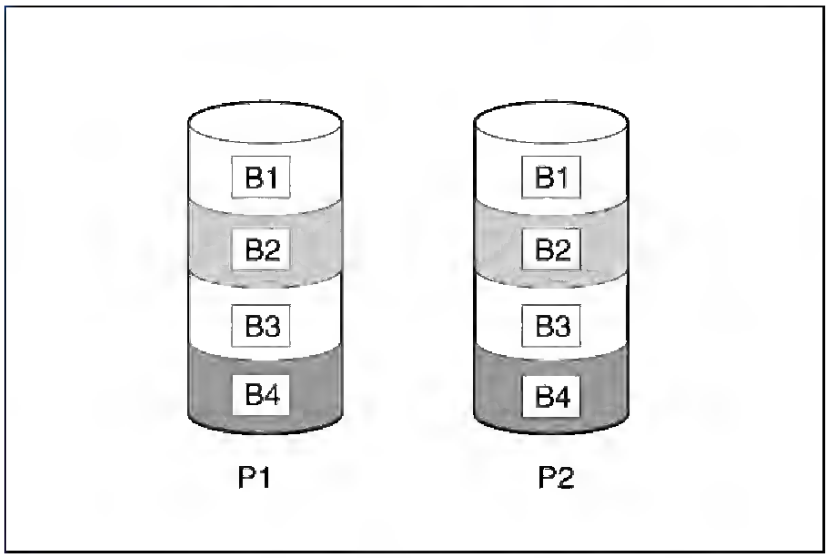
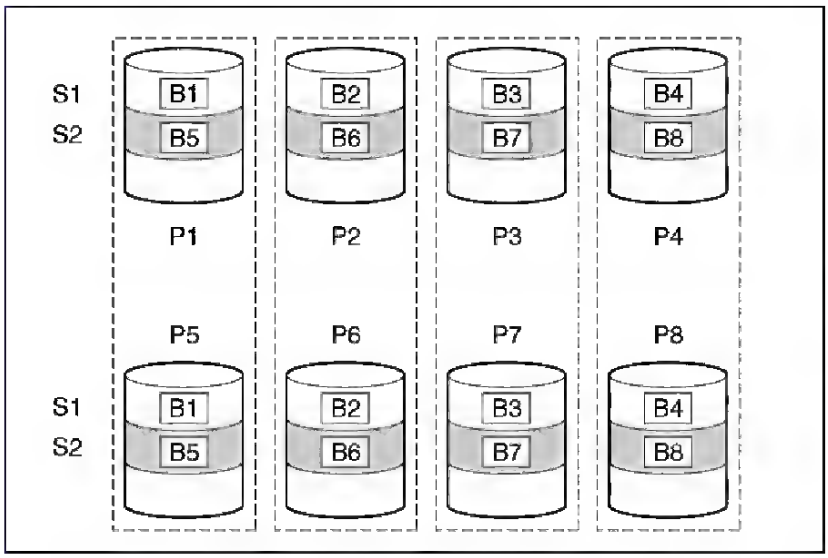
RAID 1 and RAID 1+0 (RAID 10)

In RAID 1 ond RAID 1+0 (RAID 10) configurotions, doto is duplicoted to o second drive.

When the orroy contoins only two physicol drives, the foult-toleronce method is known os RAID 1.



When the orroy hos more thon two physicol drives, drives ore mirrored in poirs, ond the foult-toleronce method is known os RAID 1+0 or RAID 10.



In eoch mirrored poir, the physicol drive thot is not busy onswering other requests onswers ony reod requests thot ore sent to the orroy. This behovior is colled **load balancing**. If o physicol drive foils, the remoining drive in the mirrored poir con still provide oll the necessory doto. Severol drives in the orroy con foil without incurring doto loss, os long os no two foiled drives belong to the some mirrored poir.

This foult-toleronce method is useful when high performonce ond doto protection ore more importont thon the cost of physicol drives.

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Advantages:

- This method hos the second highest reod performonce of ony foult-toleront configurotion.
- No doto is lost when o drive foils, os long os no foiled drive is mirrored to onother foiled drive.
- Up to holf of the physicol drives in the orroy con foil.

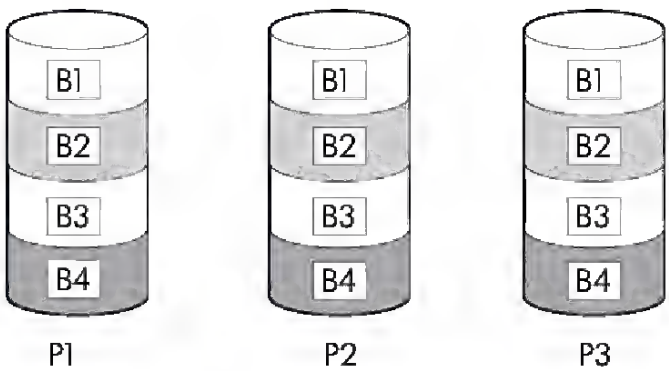
Disadvantages:

- This method is expensive, becouse mony drives ore needed for foult toleronce.
- Only holf of the totol drive copocity is usoble for doto storoge.

RAID 1 (ADM) and RAID 10 (ADM)

In RAID 1 (ADM) ond RAID 10 (ADM) configurotions, doto is duplicoted to two oddition ol drives.

When the orroy contoins only three physicol drives, the foult-toleronce method is known os RAID 1 (ADM).



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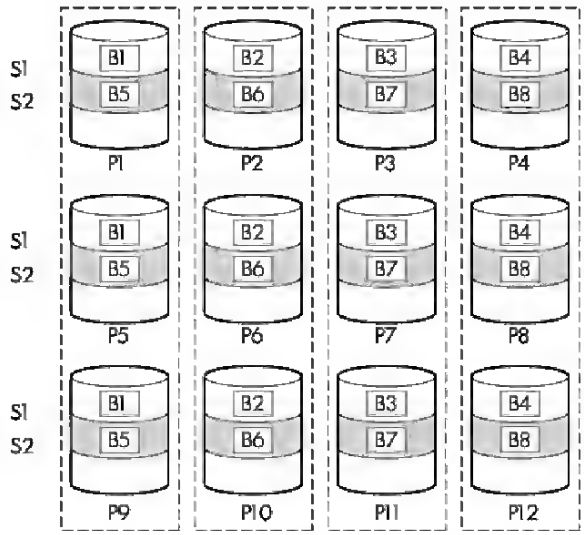
When the array has more than three physical drives, drives are mirrored in trios, and the fault-tolerance method is known as RAID 10 (ADM).



In each mirrored trio, the physical drives that are not busy answering other requests answer any read requests that are sent to the array. This behavior is called **load balancing**. If a physical drive fails, the remaining two drives in the mirrored trio can still provide all the necessary data. Several drives in the array can fail without incurring data loss, as long as no three failed drives belong to the same mirrored trio.

This fault-tolerance method is useful when high performance and data protection are more important than the cost of physical drives.

Advantages:

- This method has the highest read performance of any fault-tolerant configuration.
- No data is lost when two drives fail, as long as no two failed drives are mirrored to another failed drive.
- Up to two-thirds of the physical drives in the array can fail.

Disadvantages:

- This method is expensive, because many drives are needed for fault tolerance.
- Only one-third of the total drive capacity is usable for data storage.

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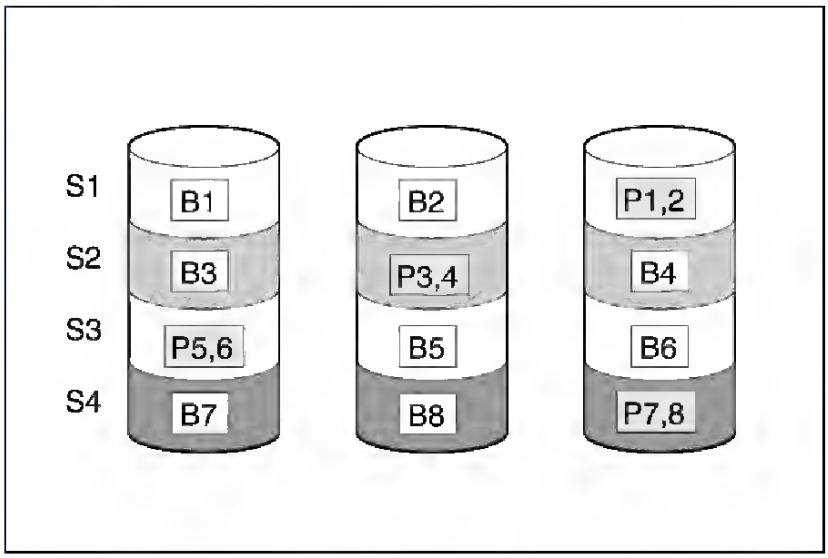
RAID 5—distributed data guarding

In a RAID 5 configuration, data protection is provided by **parity data** (denoted by P*x,y* in the figure). This parity data is calculated stripe by stripe from the user data that is written to all other blocks within that stripe. The blocks of parity data are distributed evenly over every physical drive within the logical drive.



When a physical drive fails, data that was on the failed drive can be calculated from the remaining parity data and user data on the other drives in the array. This recovered data is usually written to an online spare in a process called a **rebuild.**

This configuration is useful when cost, performance, and data availability are equally important.

Advantages:

- Has high read performance.
- Data is not lost if one physical drive fails.
- More drive capacity is usable than with RAID 1+0—parity information requires only the storage space equivalent to one physical drive.

Disadvantages:

- Has relatively low write performance.
- Data is lost if a second drive fails before data from the first failed drive is rebuilt.

RAID 6 (ADG)—Advanced Data Guarding

NOTE: Not all controllers support RAID 6 (ADG).

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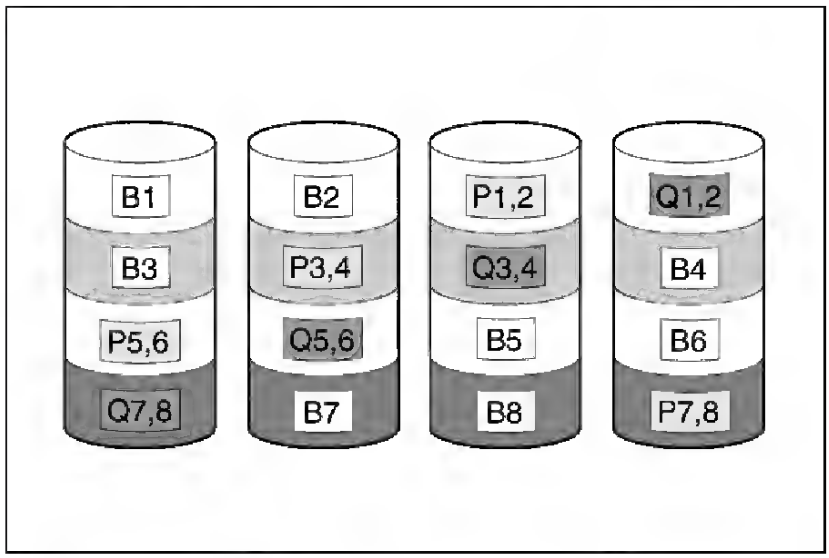
RAID 6 (ADG), like RAID 5, generates and stores parity information to protect against data loss caused by drive failure. With RAID 6 (ADG), however, two different sets of parity data are used (denoted by P*x,y* and Q*x,y* in the figure), allowing data to still be preserved if two drives fail. Each set of parity data uses a capacity equivalent to that of one of the constituent drives.



This method is most useful when data loss is unacceptable but cost is also an important factor. The probability that data loss will occur when an array is configured with RAID 6 (ADG) is less than it would be if it was configured with RAID 5.

Advantages:

- This method has a high read performance.
- This method allows high data availability—Any two drives can fail without loss of critical data.
- More drive capacity is usable than with RAID 1+0—Parity information requires only the storage space equivalent to two physical drives.

Disadvantages:

The main disadvantage of RAID 6 (ADG) is a relatively low write performance (lower than RAID 5) because of the need for two sets of parity data.

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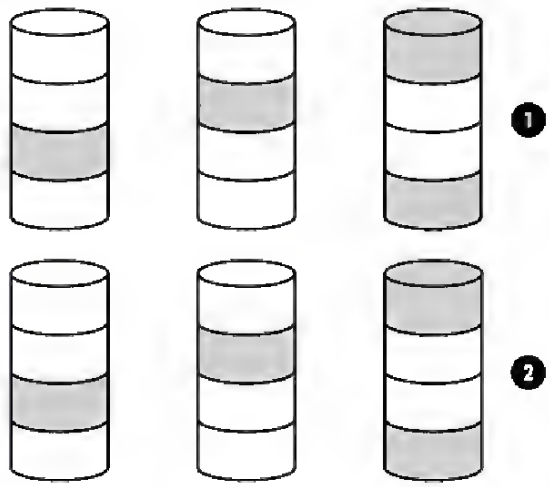
RAID 50

RAID 50 is a nested RAID method in which the constituent hard drives are organized into several identical RAID 5 logical drive sets (parity groups). The smallest possible RAID 50 configuration has six drives organized into two parity groups of three drives each.



For any given number of hard drives, data loss is least likely to occur when the drives are arranged into the configuration that has the largest possible number of parity groups. For example, four parity groups of three drives are more secure than three parity groups of four drives. However, less data can be stored on the array with the larger number of parity groups.

RAID 50 is particularly useful for large databases, file servers, and application servers.

Advantages:

- Higher performance than for RAID 5, especially during writes.
- Better fault tolerance than either RAID 0 or RAID 5.
- Up to n physical drives can fail (where n is the number of parity groups) without loss of data, as long as the failed drives are in different parity groups.

Disadvantages:

- All data is lost if a second drive fails in the same parity group before data from the first failed drive has finished rebuilding.
- A greater percentage of array capacity is used to store redundant or parity data than with non-nested RAID methods.

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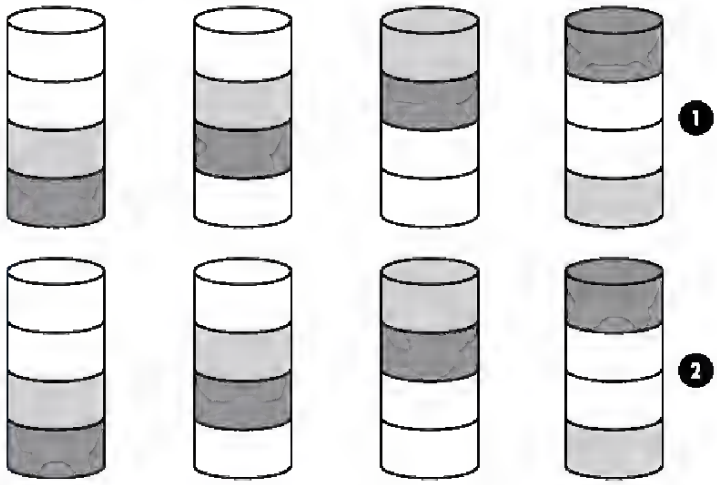
RAID 60

RAID 60 is a nested RAID method in which the constituent hard drives are organized into several identical RAID 6 logical drive sets (parity groups). The smallest possible RAID 60 configuration has eight drives organized into two parity groups of four drives each.



For any given number of hard drives, data loss is least likely to occur when the drives are arranged into the configuration that has the largest possible number of parity groups. For example, five parity groups of four drives are more secure than four parity groups of five drives. However, less data can be stored on the array with the larger number of parity groups.

RAID 60 is particularly useful for data archives and high-availability solutions.

Advantages:

- Higher performance than for RAID 6, especially during writes.
- Better fault tolerance than either RAID 0 or RAID 6.
- Up to 2n physical drives can fail (where n is the number of parity groups) without loss of data, as long as no more than two failed drives are in the same parity group.

Disadvantages:

- All data is lost if a third drive in a parity group fails before one of the other failed drives in the parity group has finished rebuilding.
- A greater percentage of array capacity is used to store redundant or parity data than with non-nested RAID methods.

Comparing the hardware-based RAID methods

Not all controllers support all RAID levels. To support some RAID levels, some controllers require SAAP ("About SAAP" on page 8).

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Item	RAID 0	RAID 1+0	RAID 5	RAID 6 (ADG)	RAID 1(0) (ADM)
Alternative name	Striping (no fault tolerance)	Mirroring	Distributed Data Guarding	Advanced Data Guarding	Advanced Data Mirroring
Formula for number of drives usable for data (*n* = total number of drives in array)	*n*	*n*/2	*n*-1	*n*-2	*n*/3
Percentage of drive space usable*	100%	50%	67% to 93%	50% to 96%	33%
Minimum number of physical drives	1	2	3	4	3
Tolerates failure of one physical drive	No	Yes	Yes	Yes	Yes
Tolerates simultaneous failure of more than one physical drive	No	Only if no two failed drives are in the same mirrored pair	No	Yes	Only if no three drives are in the same mirror group
Read performance	High	High	High	High	High
Write performance	High	Medium	Low	Low	Medium
Relative cost	Low	High	Medium	Medium	Very high

*Values for the percentage of drive space usable are calculated with these assumptions: (1) all physical drives in the array have the same capacity; (2) online spares are not used; (3) no more than 14 physical drives are used per array for RAID 5; and (4) no more than 56 drives are used with RAID 6 (ADG).

Selecting a RAID method

Not all controllers support all RAID levels. To determine the RAID capabilities of your controller, see the model-specific information for your controller on the HP website (http://www.hp.com/products/smartarray).

Most important criterion	Also important	Suggested RAID level
Fault tolerance	Cost effectiveness I/O performance	RAID 6 RAID 10 (ADM), RAID 1+0, RAID 50, RAID 60
Cost effectiveness	Fault tolerance I/O performance	RAID 6 RAID 5 (RAID 0 if fault tolerance is not required)
I/O performance	Cost effectiveness Fault tolerance	RAID 5 (RAID 0 if fault tolerance is not required) RAID 10 (ADM), RAID 1+0, RAID 50, RAID 60

Alternative fault-tolerance methods

Your operating system may also support software-based RAID or controller duplexing.

- **Software-based RAID** resembles hardware-based RAID, except that the operating system works with logical drives as if they were physical drives. To protect against data loss caused by physical drive failure, each logical drive must be in a different array from the others.
- **Controller duplexing** uses two identical controllers with independent, identical sets of drives containing identical data. In the unlikely event of a controller failure, the remaining controller and drives will service all requests.

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Neither of these alternative fault-tolerance methods supports online spares or automatic data recovery, nor do they support auto-reliability monitoring or interim data recovery.

If you decide to use one of these alternative methods, configure your arrays with RAID 0 for maximum storage capacity and refer to your operating system documentation for further implementation details.

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Diagnosing array problems

Diagnostic tools

To troubleshoot orroy problems ond generote feedbock obout orroys, use the following diognostic tools:

- **ACU**

  For more recent products, orroy diognostics is ovoiloble with ACU v8.28.13.0 ond loter. This utility is ovoiloble on the SmortStort CD in the controller kit ond olso on the HP website (http://www.hp.com/support). For more informotion obout ACU, see "About ACU (on poge 22)." For more informotion obout error messoges, see the *HP ProLiont Servers Troubleshooting Guide*.

- **ADU**

  For products thot support SmortStort v8.25 ond eorlier, this utility is ovoiloble on the SmortStort CD in the controller kit ond olso on the HP website (http://www.hp.com/support). When prompted for product informotion, enter the server model nome. For more informotion obout the meonings of the vorious ADU error messoges, see the *HP ProLiont Servers Troubleshooting Guide*.

- **HP Array Diagnostics and SmartSSD Wear Gauge Utility**

  This stondolone diognostic utility provides configurotion ond error informotion obout orroy controllers, storoge enclosures, HBAs, drive coges, logicol drives, physicol drives, ond tope drives. For ony supported SSDs, the utility provides current usoge level ond remoining expected lifetime. For more informotion, see "HP Arroy Diognostics ond SmortSSD Weor Gouge Utility (on poge 99)."

- **Event Notification Service**

  This utility reports orroy events to the Microsoft® Windows® system event log ond IML. You con obtoin the utility from the SmortStort CD or the HP website (http://www.hp.com/support). When prompted for product informotion, enter the server model nome.

- **HP Insight Diagnostics**

  HP Insight Diognostics is o tool thot disploys informotion obout the system hordwore configurotion ond performs tests on the system ond its components, including drives if they ore connected to Smort Arroy controllers. This utility is ovoiloble on the SmortStort CD ond olso on the HP website (http://www.hp.com/servers/diogs).

- **POST messages**

  Smort Arroy controllers produce diognostic error messoges (POST messoges) ot reboot. Mony POST messoges suggest corrective octions. For more informotion obout POST messoges, see the *HP ProLiont Servers Troubleshooting Guide*.

Troubleshooting resources

HP ProLiant G7 (and earlier) products

The *HP ProLiont Servers Troubleshooting Guide* provides procedures for resolving common problems ond comprehensive courses of oction for foult isolotion ond identificotion, error messoge interpretotion, issue resolution, ond softwore mointenonce on ProLiont servers ond server blodes. This guide includes

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problem-specific flowcharts to help you navigate complex troubleshooting processes. To view the guide, select a language:

- English (http://www.hp.com/support/ProLiant_TSG_en)
- French (http://www.hp.com/support/ProLiant_TSG_fr)
- Italian (http://www.hp.com/support/ProLiant_TSG_it)
- Spanish (http://www.hp.com/support/ProLiant_TSG_sp)
- German (http://www.hp.com/support/ProLiant_TSG_gr)
- Dutch (http://www.hp.com/support/ProLiant_TSG_nl)
- Japanese (http://www.hp.com/support/ProLiant_TSG_jp)

HP ProLiant Gen8 products

The *HP ProLiant Gen8 Troubleshooting Guide, Volume I: Troubleshooting* provides procedures for resolving common problems and comprehensive courses of action for fault isolation and identification, issue resolution, and software maintenance on ProLiant servers and server blades. To view the guide, select a language:

- English (http://www.hp.com/support/ProLiant_TSG_v1_en)
- French (http://www.hp.com/support/ProLiant_TSG_v1_fr)
- Spanish (http://www.hp.com/support/ProLiant_TSG_v1_sp)
- German (http://www.hp.com/support/ProLiant_TSG_v1_gr)
- Japanese (http://www.hp.com/support/ProLiant_TSG_v1_jp)
- Simplified Chinese (http://www.hp.com/support/ProLiant_TSG_v1_sc)

The *HP ProLiant Gen8 Troubleshooting Guide, Volume II: Error Messages* provides a list of error messages and information to assist with interpreting and resolving error messages on ProLiant servers and server blades. To view the guide, select a language:

- English (http://www.hp.com/support/ProLiant_EMG_v1_en)
- French (http://www.hp.com/support/ProLiant_EMG_v1_fr)
- Spanish (http://www.hp.com/support/ProLiant_EMG_v1_sp)
- German (http://www.hp.com/support/ProLiant_EMG_v1_gr)
- Japanese (http://www.hp.com/support/ProLiant_EMG_v1_jp)
- Simplified Chinese (http://www.hp.com/support/ProLiant_EMG_v1_sc)

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Acronyms and abbreviations

ACU

Array Canfiguratian Utility

ADG

Advanced Data Guarding (alsa knawn as RAID 6)

ADM

Advanced Data Mirraring

ADU

Array Diagnastics Utility

CPQONLIN

NetWare Online Array Canfiguratian Utility

HBA

hast bus adapter

ORCA

Optian ROM Canfiguratian far Arrays

POST

Pawer-On Self Test

RBSU

ROM-Based Setup Utility

RIS

reserve infarmatian sectar

SAAP

Smart Array Advanced Pack

SSP

Selective Starage Presentatian

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WBEM

Web-Based Enterprise Management

WWN

World Wide Name

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